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THE GEOGRAPHY OF SOUTH AMERICAN RAILWAYS

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Continued from page 201. *Map following p.* 320.

CHILE

THE configuration of Chile is unique, not only in South America but in the whole world. The physical factor here dominates all railway construction and a sketch of the main features of the country also roughly outlines the general plan of its land transport. The breadth of the Republic, from the Pacific to its Argentine and Bolivian frontiers, varies from 105 to 248 miles, but its length from Peru through 38° of latitude to Magellan is no less than 2627 miles. Placed across the North Atlantic Ocean, Chile would form a bridge of land joining Quebec to Liverpool, with most of its snow-clad Cordilleras projecting in a continuous line above the ocean. Its surface, running like a ribbon between the Andes and the Pacific, exhibits in this length an extreme diversity, passing from the waterless mineral regions of the north, through the fertile and wheat-growing central provinces, till it reaches broken archipelagoes, the beech-covered hills, and the patches of Patagonian pampa facing the Straits of Magellan.

For its railways as well as for geographical purposes, Chile might hitherto have been divided according to the zones above described, but lately its railway map has undergone a radical alteration. This is due to the construction of the so-called "*Longitudinal railway*," running due north and south, and linking up practically every line in the country with its capital, Santiago, and with its chief port, Valparaiso. Prior to this development, the railways in the desert northern section, from the Peruvian frontier to Valparaiso, were all isolated lines built inland from the coast, with the object of exploiting nitrate and other mineral deposits. In the neighbourhood of Valparaiso an increasing rainfall permits some agriculture, which is supplemented where possible by irrigation from the numerous hill streams. The central zone includes the most populous districts in Chile, together with its chief cities, Valparaiso and Santiago. Here the railways have been constructed as a continuous system, the majority being owned by the State under the name of "*Red Central*" or "Central Network."

Mineral production is still important, since the district embraces the chief coalfields of Chile, with an output of about 1,000,000 tons per annum; but the main livelihood of the population is derived from agriculture, vine-growing, and stock-raising.

The general plan of this central railroad is that of a single trunk-line running south from Santiago to Puerto Montt (facing the Chonos Archipelago in lat. S. 41° 29′), with branches running east up the slopes of the Andes, or west through fertile valleys to sheltered coast ports. In the northern section, where railways are urgently in need of good harbours to handle their heavy nitrate and mineral output, these are conspicuously lacking, and the shippers handle millions of tons of cargo yearly in open roadsteads backed by the coast "barrancas," from piers or landing-stages only slightly protected from the heavy Pacific swell. No one lives in this uncomfortable, arid northern region for choice. As the city man seeks his home in a green suburb after a day's toil amid bricks and mortar, so the Chilean merchant or labourer looks to settle finally in the cool, well-watered, and fertile southern provinces. Nowhere else in South America does just this same distinction exist, and Chileans of all classes are in consequence more used to travel and better acquainted with their own country than is the case with their neighbours.

The last section of Chile, from Puerto Montt southward to Cape Horn, has been and is likely to remain for many years destitute of railways. After it reaches Puerto Montt the valley between the inland and coast Cordilleras drops below sea-level, the coast range is represented by a series of islands, and the main or inland chain is deeply cleft by fjords and rivers. The rainfall in southern Chile is one of the heaviest on the continent, rising to 100 inches per annum, and only exceeded in the Amazon Valley. At present its only railways consist of 96 km. between Ancud and Castro ports on Chiloe Island, and of 8½ km. of an industrial line connecting the lignite mine of Loreto with Punta Arenas (Sandy Point), within the Straits of Magellan. Constructed in 1875 this short Loreto line was, and is likely to remain, the most southerly in the world.

Although the broken aspect of this southernmost zone of Chile has caused it to be thus far avoided by the railway engineer, its study enables us to more readily picture the obstacles confronting his work in the centre and north of the Republic. The coast and inland Cordilleras of the Andes have risen here many thousands of feet, and the intermediate valleys are themselves high above sea-level. In the place of islands we have mountain peaks; isthmuses become lofty ridges; fjords and channels are replaced by transverse valleys with running streams. The great longitudinal valley never entirely disappears, but it varies greatly in aspect. Its average width is about 50 km. (31 miles), but between lats. 33° and 35° the enclosing mountain ranges approach each other so closely as to leave only narrow defiles. This is due to a "Nudo" or knot, characteristic of the Andean Cordilleras, which commences near Cabildo and continues

for some 250 miles north of Santiago, the ranges again separating definitely in lat. 29° S. Once the gorge of the Copiapo River is passed (lat. 27° 20′) the Central Valley runs clear to the frontier of Peru, reaching its maximum width of 100 km. amid waterless nitrate deposits near Antofagasta.

In the central section and even south of Santiago the levels of the longitudinal floor are low and regular, the rise from Puerto Montt to Talca, a distance of 832 km. (515 miles), being only 400 feet. From Talca north levels vary greatly, rising to 1860 feet at Santiago and 4600 feet at Pampa Alta (Antofagasta), with many local and abrupt variations. The rapid changes of level due to the transverse obstacles already noted for years restricted the building of a north and south line, since they obviously entailed very heavy expenses not only for immediate construction but during all subsequent operation.

The Longitudinal Railway.—This great valley traversing the whole length of the inhabited portion of Chile inevitably suggested a continuous north and south railway as the equally dominant factor in the Republic's railway system. Although it has only lately been carried into effect, Chilean statesmen and engineers have from the earliest days of railway construction had the longitudinal project in their minds. The first section of the present "Red Central" was laid in the valley immediately after the inauguration of the Valparaiso–Santiago Railway, which was of course a primary necessity. Even when Chile's first concession, that of the Coquimbo–Ovalle Railway, was granted in 1855, it was stipulated that its line should be of the same broad gauge (*i.e.* 5 feet 6 inches) as that of the Santiago Railway, with which it would be ultimately joined. The Government of that date, however, did not fully realize the difficult nature of the country separating the two lines, which has resulted in the longitudinal railways in the north being later constructed to the narrower gauge of 1 metre instead of 5 feet 6 inches.

A preliminary survey of the Republic such as we have outlined, had it then existed, would have shown that, contrary to popular belief, a longitudinal railway through Chile must certainly overcome greater difficulties than the earlier transverse railways built from the coast towards the Andes. Many of the peninsulas, now appearing as abrupt hill-spurs, cross the Central Valley at right angles. Even in its wider portions the main valley is cleft by river-beds, whose east-and-west gradients are of great assistance to the cross-country lines, but a proportionately serious obstacle to the longitudinal system. In the section of the Longitudinal Railway between Cabildo and San Marco, some 60 km. of rack railway with gradients as high as 6 per cent. were found necessary. Elsewhere a 3 per cent. gradient is common, and numerous tunnels varying from 300 to 1500 metres in length are employed.

As these difficulties became better known, the completion of the central longitudinal line was constantly postponed, and an alternative scheme

along the coast was advocated. This project was actually entered upon, and a line built northwards from Rayado, intended to reach the port of Los Vilos, is a section of it; but the comparatively small value of a coast railway, either for strategic or commercial purposes, lead to a revival of the Central Valley scheme. In 1908, in the face of strong opposition, President Montt passed a law sanctioning the construction of such longitudinal lines as were necessary to finish the line to the Gulf of Chiloe in the south and, by providing links between the isolated northern systems, to establish a continuous railway between Santiago, the capital, and its northernmost terminal at Arica. Save for the final prolongation to Arica, this programme was completed in 1914, and rail communication from north to south now exists between the port of Pisagua (Dept. Tarapacá) and Puerto Montt, a distance roundly of 3000 km. of track. Three different gauges are employed on these through lines, viz. 1 metre 4 feet 8½ inches, and 5 feet 6 inches.

TABLE E.

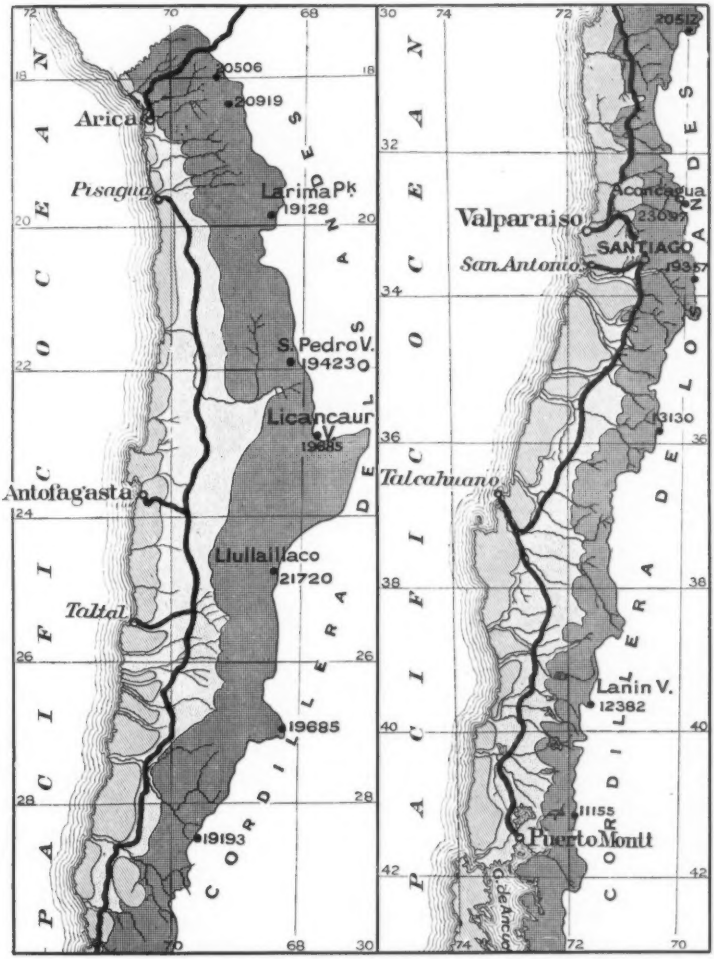
Proportion of Railways operated by State and by Private Companies in South America (1914–15).

	Total of all Railways, 1914-15. Km.	*Railways operated by private companies. Km.*	*Railways operated by State. Km.*	*Proportion to total. Operated by private companies. Per cent.*	*Operated by State. Per cent.*
Brazil	25,506	21,587	3,919	84·6	15·4
Uruguay	2,585	2,562	23	99·1	0·9
Paraguay	587	587	—	100·0	—
Argentina	36,531	30,026	6,505	82·2	17·8
Chile	8,379	4,805	3,574	57·4	42·6
Bolivia	1,333	1,092	241	82·0	18·0
Peru	2,828	2,828	—	100·0	—
Ecuador	644	644	—	100·0	—
Colombia	1,108	878	230	79·3	20·7
Venezuela	936	936	—	100·0	—
British Guiana ...	152	152	—	100·0	—
Dutch Guiana ...	140	140	—	100·0	—
Totals for all South America	80,729	66,237	14,492	82·05	17·95

NOTE.—It should be noted that while operation of a railway in South America by the State always implies State ownership, the same rule does not hold good with regard to railways operated by private companies. The present State policy throughout the Continent is for Governments only to grant concessions which embody eventual purchase by or reversion to the State. The proportion of Government-leased or owned lines in all Republics is much larger than would appear by the above table, many such being operated, under different charters and state guarantees, by private companies.

Chilean State Railways.—The energy with which Chile has attacked her transport problems appears in Table E, which shows that her kilometrage of State-owned *and operated* railways is higher in proportion to the total than in any other Republic. Sixty-one per cent. of the 8379 km. of railways in Chile are actually owned by the Government, and of these 3574 km., or 42 per cent., are operated under the State railway system.

THE GREAT LONGITUDINAL VALLEY OF CHILE SHOWING RAILWAY



TALTAL PORT AND RAILWAY, CHILE

ARICA-LA PAZ RAILWAY WORKS AT ENTRANCE TO QUEBRADA PUJIOS

A study of Table B (see the March number of the *Geographical Journal*, page 165) will show, however, that although her statesmen early appreciated the advantages of a uniform gauge within the Republic, there is no country in South America which has departed further from its first ideals in this respect. Although the majority of the "freak" lines are short, nothing can gloss the fact that there are twelve different gauges under operation in Chile to-day.

The President's message of July 1913 stated that at that date 2575 km. were in construction, while surveys for an additional 5103 km. were in progress, including the last prolongation of 210 km. on the longitudinal from Zapiga station (opposite Pisagua port) to Arica, the starting-point of the Arica–La Paz (Bolivia) Railway. The war has temporarily stopped construction, but if this final section is carried through Chile will have a complete rail system from the Peruvian frontier south to Puerto Montt, and the only section of this long line not in the hands of the State will be a portion of the Nitrate Railway Company's lines between Zapiga and Pintados.

Transandine Railways and Projects.—Possibly owing to the restless character already noted in the Chilean nation, their railways include a surprising number of lines which profess as a final objective the crossing of the Andes. In addition to the three existing international lines leading out of Chile (the *Arica–La Paz*, the *Antofagasta and Bolivia*, and the *Chilean Transandine*), the following are a few of the so-called Transandine railways surveyed or constructed, which figure largely in official and other printed matter :—

List of Chilean Transandine Projects.

(*Figures of kilometrage given in brackets indicate the distance from Santiago to the various terminal points along the Central main line at which the branch railway starts. It will be noted that these projects are more numerous south of the Valparaiso–Buenos Aires route, where the passes of the Andes quickly lower their elevation.*)

1. From Mejillones to Salta (see also "The First Transandine Railway," *Geographical Journal*, November 1910).
2. „ Copiapó to Tinogasta : "Copiapó Railway."
3. „ San Bernardo (km. 16) *viâ* San José and Volcan : "Transandino por Maipó."
4. „ Tinguiririca (km. 139) *viâ* Las Damas.
5. „ Curicó (km. 185) *viâ* Los Quenes and Planchon.
6. „ Talca (km. 250) *viâ* Risco Bayo : "Transandino por Maule."
7. „ San Carlos (km. 374) *viâ* Naheuve River : "Transandino por Nuble."
8. „ Chillán (km. 398) *viâ* Recinto.
9. „ General Cruz (km. 446) *viâ* Polcura.

10. From Monte Aguila (km. 465) *viâ* Trupán and Antuco: "Transandino por Antuco."
11. „ Caucatin Puá (km. 637) *viâ* Lonquimay and Pino Rachado: "Transandino por Neuquen."
12. „ Cajon (km. 680) *viâ* Llaima.
13. „ Loncoche (km. 770) *viâ* Villarrica.
14. „ Collilelfú (km. 851) to San Martin de Los Andes *viâ* Lake Rinihue: "Transandino San Martin."
15. „ Valdivia to San Antonio (*viâ* Lake Nahuel Huapi).

Even should the above fifteen courageous lines scale their mountain barriers, only the Caucatin–Pua and the Collilelfú constructions have any present prospect of finding a counterpart on the Argentine side of the frontier.

The Collilelfú to Pirehueico, or "Transandino San Martin," to give this enterprise its more popular name, aims at linking up a series of three long narrow lakes, lying within the Andean valleys of Patagonia, where their general course is east to west. Of these lakes Rinihue and Pirehueico are on the Chilean side, and Lake Lacar on the Argentine. The San Martin Company has connected these lakes with the "Red Central" State system of Chile by a series of short, linked lines. So far the scheme is rational; but beyond the frontier the only possible connection would be by a prolongation of the Argentine (Patagonia) State Railway building inland from Port San Antonio. This line has already traversed the Patagonian tablelands; but between its present railhead and Lake Lacar lie tangled masses of mountains, which could only be crossed at heavy expense for the sake of a scant cattle traffic. Moreover, it duplicates the Buenos Aires and Great Southern line through Neuquen, only 150 km. further north. The project is so unattractive as to hardly merit discussion, were it not that this Argentine section is frequently referred to officially as the "Trans-continental de San Antonio a Valdivia."

The Caucatin construction, on the contrary, which starts from Pua station on the "Red Central" (642 km. south of Santiago) and runs its broad-gauge track towards the Andes, is definitely destined to be the Chilean section of the second Transandine and Trans-continental route, connected by the lines of the Buenos Aires Great Southern Railway to an Atlantic terminal at Bahia Blanca (see also reference under "Argentina" earlier in this paper). The pre-war date for completion of the Argentine section was fixed at 1919.

The remaining thirteen projects above tabulated are frequently referred to in Chilean publications as if they were already part of some complete Trans-continental system, in spite of the fact that the much more lengthy sections on the Argentine side are, and seem likely to remain, entirely absent. The advocates of these costly constructions cannot even claim, as is the case with parallel projects in Peru, that they link a Chilean

hinterland lying east of the Andes to the Chilean seaboard. Such projects therefore must be attributed to the impatience felt by a virile and ambitious people, living in provinces hemmed straitly between the mountains and the sea, rather than to any serious study of the requirements of the Republic as a whole.

Chilean International Railways.—The "Transandino por Juncal," *i.e.* the Valparaiso–Buenos Aires line, is not only the single railway running between Chile and Argentina, but the only Transcontinental line so far completed in South America. The details of this line have been often given; the impression however that the railway is a single working unit will bear correction. In reality the line connecting the Chilean and Argentine capitals is a chain composed of six links, each the property of a separate company, viz. Valparaiso to Las Vegas (91 km.); Las Vegas to Los Andes (45 km.); Chilean Transandine (70 km.); Argentine Transandine (178 km.); Mendoza to La Paz (140 km.); and La Paz to Buenos Aires (923 km.). The total distance from Valparaiso to Buenos Aires is thus 1445 kms., of which the entire Argentine portion is practically controlled by the Buenos Aires and Pacific Railway. There is a change on either side of the Andes from broad to metre gauge, the rack system being freely used on the latter (Transandine) sections. Partly owing to this fact, during the winter months, that is to say, from June to October, serious breakdowns and delays have been the rule rather than the exception on the Transandine lines, especially on the Chilean side. This is due not only to heavy snowfalls among the mountains, but also to the more serious defect that open portions of the line at its highest point, *i.e.* below the summit tunnel, and well within the snow-line, are laid on a hillside whose surface is subject to mud-slides and boulder-falls at each melting of the winter snows. The cost of a new tunnel at lower levels would be at present prohibitive, probably involving the use of electric motive power. The only alternative to the constantly recurrent blocking and pinching out of this part of the line is to convert the dangerous portions into an integral part of the mountain-side by extensive retaining walls and concrete snowsheds, thus adding heavily to an already excessive expenditure. It will be instructive here to compare the construction cost to date and the cost of the three most spectacular undertakings in South America. The Argentine and Chilean Transandine Railways, totalling 248 km., have cost £4,462,000. The Madeira–Mamoré Railway of 364 km. cost £4,700,000. The 247 km. of the São Paulo Railway have accounted for £6,600,000. Heavy fresh expenditure is foreshadowed on all three lines.

The Arica–La Paz (International) Railway, which starts from the port of Arica (formerly Peruvian territory) and ascends the Andes to La Paz, has supplied Bolivia with its latest and shortest Pacific coast outlet, effecting a saving in distance of 500 km. as compared with the alternative Chile–Bolivia route from Antofagasta port. The up-journey on the Arica route

occupies about eighteen hours by passenger train, with some saving in time on the down journey. Thirty-six km. of rack rail with maximum 6 per cent. gradient are employed, many of the disadvantages of the rack system being minimized on this arid and waterless coast section. The Arica–La Paz railway is probably the only strategic line, in a strictly military sense, in South America, although it is not openly so declared. It safeguards to Chile the ownership of the nitrate provinces of Tacna and Arica, provisionally administered by Chile after her war with Peru. Their title to ownership has never been definitely agreed between the two Republics, the decision being nominally reserved for a plebiscite of the population affected, the date of which is constantly postponed. Furthermore, the coast strip comprised in these two provinces was always recognized as Bolivia's freehold on the Pacific Ocean. Under a treaty made in 1904 the Chilean Government undertook, in return for cancellation of all claims to a coast frontage by Bolivia, to construct and pay for the Arica–La Paz railway. A further Protocol, however, signed at Arica in May 1913, on the opening of the line, specified that until May 1928 both the Chilean and Bolivian sections are to be operated by the Chilean Government. When the fifteen years have expired the Bolivian section will be handed over to the Government of that country. The construction of the Arica–La Paz railway thus not only gives Chile further vested interests in provinces whose ownership is still disputed by Peru, but also confirms the short-sighted blockade which makes of Bolivia the only Republic in South America (save the entirely different case of Paraguay) lacking its birthright of an ocean frontage.

BOLIVIA

Like Paraguay, Bolivia is an inland Republic. Political necessity has time after time forced her to relinquish her claims, both historical and geographical, to outlying portions of her territory, so that to-day the country's formidable natural ramparts mark interior rather than exterior boundaries. Her lands are a hinterland to the maritime States, and much of her outlying territory is, save for the political tie, more closely connected with the progress of these adjacent Republics. In spite, or because of this fact, no fewer than three international lines already cross Bolivia's borders, and two more will shortly be finished. Those in operation are (1) *The Peruvian Southern Railway* from Mollendo to Lake Titicaca, which enters La Paz through its control of the Guaqui–La Paz Railway, the through service having been in operation about seven years; (2) *The Arica–La Paz* (State) line, which was formally opened in May 1913, the shortest route to the Pacific coast; and (3) *The Antofagasta and Bolivia Railway*, serving the Bolivian plateau, which completed its direct connection with La Paz in 1915. To these will shortly be added (4) a line linking *Uyuni* (*Antofagasta Railway*) to *La Quiaca* on the Argentine frontier, of which 201 km. are still under construction for

Government account; and (5) an *extension of* 120 *km.* of the Brazilian *Madeira–Mamoré Railway* bridging the latter stream and passing through Bolivian territory to Riberalta, above the Esperança Falls of the Lower Beni. This line has also been commenced, but construction is at present suspended. The possession of five international lines will constitute for Bolivia a South American record.

The Pacific Outlets.—We may first usefully review the three lines which connect La Paz with the Pacific coast. The *Antofagasta and Bolivia* line begins on a 2 feet 6 inch gauge, but changes to the Bolivian 1 metre gauge at the frontier. On its further northward route along the plateau the railway connects by branch lines with the chief Bolivian provincial capitals, viz. Tupiza, Potosi (whence an extension is planned to Sucre, the ancient capital), Oruro, a mining centre, and Cochabamba, the garden city of the eastern Andes. From Antofagasta port to La Paz the line is 1162 km. long, and the journey occupies forty-three hours.

The ascent by the *Peruvian Southern Railway* from Mollendo to Puno is made on the standard (4 feet 8½ inches) gauge, the distance being 524 km. Then comes a picturesque steamer trip of some 200 km. on Lake Titicaca (12,838 feet above sea-level) as far as the Bolivian port of Guaqui, in full view of the snow-clad inland Cordillera, rising to over 22,000 feet from the peaks of Sorata to the splendid saddle-crest of Illimani. The summer snow-line of the Andes in Bolivia and Peru occurs at about 16,000 feet. A further 98 km. of line leads from Guaqui port across the stony "Alto," winding up with a sensational 1400-feet descent on an 8 per cent. gradient by electric line into the deep valley of La Paz River, in which the Bolivian capital lies hidden. The total rail and lake journey from Mollendo is therefore about 822 km., and the down journey is covered in twenty-eight hours. A projected loop from Puno to Guaqui, round the western shore of the lake, would materially shorten the time though not the distance covered. The journey on the Peruvian southern branch from Puno, which crosses the transverse Vilcanota range (14,536 feet) to Cuzco (11,000 feet), the ancient capital of the Incas, should be made by all travellers wishing to catch a glimpse of old Peru. Should Cuzco ever be joined by rail to the Peruvian Central (Oroya) line, this branch will form part of the much-discussed railway along the Andean plateau, which would link Lima to La Paz, and so with Buenos Aires.

The third Pacific line, *Arica to La Paz* (already noticed under "Chile"), is only 439 km. in length, with a journey of eighteen hours. This route has the added advantage that Arica harbour offers a better anchorage for ocean vessels than either Mollendo or Antofagasta roadsteads.

All these three mountain lines scale the coast Andes at high altitudes. The summit pass on the Antofagasta Railway at Ascotan is nearly 13,000 feet, and thence north along the Bolivian plateau the railway runs at an almost uniform level of some 12,000 feet. A spur line to the Collahausi mines reaches 15,809 feet, and the Potosi branch crosses the inland Andes

at 15,814 feet. The Southern Railway crosses the Pacific water-parting at 14,666 feet near Crucero Alto (259 km. from Mollendo). Both the Antofagasta and the Peruvian Southern railways use ordinary adhesion in ascending to these great altitudes, the latter employing a maximum 4 per cent. gradient over considerable distances. The Arica–La Paz line, however, which ascends by the waterless Quiroz defile and crosses the coast range at 14,100 feet, uses 36 km. of rack section at different points. On all these Bolivian lines, as well as on the other Pacific coast mountain railways, the traveller must revise his ideas of what a locomotive may be legitimately asked to do. Overshadowed by the giant bulk of the Andes, or standing on the interminable stony plateaux of the Altaplanicie, he will regard the solitary rail-track, the standing evidence of incredible pioneer toil, with a personal affection that more complicated transport systems at home quite fail to arouse in his breast.

The major problem which from early days has confronted Bolivian statesmen, namely that of gaining an undisputed outlet for their country westward to the Pacific coast and eastward to the Amazon main river, has therefore now been solved, though only at heavy sacrifice of Bolivian soil, by Chile's undertaking of the Arica–La Paz line on the coast, and in the hinterland by the building of the Madeira–Mamoré Railway by Brazil. Bolivia was at the same time granted by Brazil the right of free navigation on the Acre, Madeira, Amazon, and Paraguay rivers. The further task of uniting Bolivia's remaining outlying provinces by rail with La Paz has yet to be faced. This eternal problem especially affects the department of Santa Cruz, in the south-east, adjoining the Paraguayan and Argentine Chacos. The Santa Cruz pampas offer the finest area of undeveloped cattle pastures in South America, outside of Argentina. They lie 500 to 1000 feet above sea-level, from the Pilcomayo River as far north as the low Chiquitus Sierras, near the source of the Paraguay. Failing early rail connection with La Paz, the development of this productive zone will probably devolve on Argentina. (See also section "Argentina" in March *Journal*, page 192.)

The Amazon Outlet.—The second outlying territory in urgent need of rail connection with the Bolivian plateau is that lying upon the eastern slopes of the Andes, comprising about one-half of the total area of the Republic. Its sole outside means of access is at present from the Amazon and the Atlantic coast by the Madeira–Mamoré Railway. In this condition it is likely to remain some considerable time, for the problem of constructing railways down the Eastern Andes is no light one. Neither Bolivia, Peru, Ecuador nor Colombia, all Republics with a vital interest in attaching their tropical Amazon hinterlands by rail to their capitals, have yet succeeded in the task. Throughout this whole region the passes of the inland or snow-clad Cordillera (which in Bolivia forms the main Andes) vary from 15,000 to 17,000 feet in height. A natural passage from the Altoplanicie to the Amazon basin is found in the gorge of the La

Paz River, whose headwaters have eaten back through the range round the base of Illimani. The La Paz valley route however presents equal difficulties in railway construction and is moreover much longer than the high direct route across the range, planned from La Paz to the fertile Yungas district. Even allowing for a long summit tunnel, a line built anywhere down the north-west Andes on the Amazon side must drop at least 12,000 feet before reaching any practicable river navigation. The mountain flanks are soaked with a heavy rainfall and smothered in jungle vegetation grown on rotting limestones and creeping shales. Similar railways actually in operation are the Girardot line, which ascends 8000 feet from the Magdalena River to the Bogotá plateau, and the Guayaquil–Quito Railway. Even these pioneer examples of mountain-railroad building in the north-west tropics of South America hardly forecast the difficulties which await the operation of the first railway from the Altoplanicie down into the Amazon basin. The Antofagasta Railway has, nevertheless, already made a long step in this direction by its branch across the inland Cordillera, from Oruro (12,121 feet), to the railhead now nearing Cochabamba (8367 feet). From Cochabamba a light electric railway carries the metre-gauge 20 km. further, and routes have been surveyed for another 200 km. to the navigable waters of the Chimoré, Securé, and Chapuré rivers, which eventually flow to the Madeira. Should any extension downhill from Cochabamba be ultimately built, it would thus prolong the difficult mountain section already overcome by the Antofagasta and Bolivia Railway constructions.

Apart from political motives, the primary object of prolonging Bolivia's transandine railways down to the Amazon basin is not to establish an outlet for her upland exports, *viâ* the Atlantic, a route which obviously could not compete with the shorter route to the Pacific ocean and thence to European and North American markets, especially since the opening of the Panama Canal. These Amazon projects are planned to supply the bulk of the nation, who live on the barren Altaplanicie, with tropical foodstuffs such as maize, mandioca, fruits, with the indispensable coca-leaf, and above all, with fuel which is completely lacking in Upper Bolivia. The utmost industry of the Indian on the "Alto" only achieves a little barley and patches of frost-bitten potatoes, although sheep and llamas on the hillsides and a few hardy cattle in the valleys find sufficient pasturage. The Altaplanicie, however albeit barren and cold, is extremely healthy. Despite its greater fertility, the Bolivian Indian dreads life in the low-lying hinterland, with its rubber plantations, its fevers, and its insect pests. Following the Inca traditions, centres of Bolivian population cluster round the snow-capped Andes and their high-perched lakes. As railway constructions stand at present, the first tropical and forest produce to reach the Altoplanicie cities direct by rail, instead of on muleback, will probably come from Jujuy and the Argentine Chaco, as soon as Bolivia completes the Uyuni–La Quiaca gap in her international line southward.

These Altaplanicie, or main valley floors of the high Andes, which extend for 2000 miles from northern Ecuador to Argentina, are composed chiefly of clay and boulder conglomerate, filled to its present uniform level by inland drainage and violent flood action, which diminished with the gradual desiccation attending successive uplifts of the Andes. Excellent cross-sections of this floor are shown for 1000 feet below the general surface level in the La Paz Valley, and I observed a similar section near the Quinza Cruz Sierra, about 100 miles further south. The summits of half-covered hills rise along these central plateaux like islands out of a stony sea. The Altaplanicie of Bolivia, to counteract its barrenness, is one of the most highly mineralized regions in the world. Transport troubles are minimized by the fact that many of its mines yield precious or semi-precious metals. Of these latter, copper, tin, antimony, wolfram and bismuth are the principal, but silver-mines at Potosi and elsewhere maintain their old Spanish reputation, while all the inland Andes, especially in their lower slopes and Amazon river-beds, yield gold. La Paz itself is founded on an old placer-gold deposit. It is for the development of Bolivia's mineral resources that the completion of the through railway from La Paz to Buenos Aires is chiefly desired. The citizen of Argentina who travels north from the pampas to this high country will see from his Pullman car a new land with strangely new horizons. To Bolivia there appears to be a natural complement between the limitless yield of the pastures and cornfields of Argentina and the no less real but unexploited mineral treasures of her own mountain ranges.

It is perhaps due to the certainty that such reserves of treasure really exist that the traveller in Bolivia notes there a general optimism. After a long period of virtual isolation from their neighbours, the results of the strenuous Bolivian railroad programme of the last ten years are now showing. Bolivia has definitely resigned her ocean frontage and accepted her position on the high Andean hinterland, but she still holds an important central position with well-established roads guaranteed to either ocean. The mere area of the cloud-capped Republic—it ranks fourth in South America—entitles Bolivia to the respect of her neighbours. If the gaps between the Bolivian, Peruvian, and Argentine railroad systems along the high Andes are ever completed, we may see a readjustment in the relative values of the Pacific coast lines. In the long run the "Inca Highway," the old Altaplanicie route from north to south, will reassert its influence and La Paz will then lie, as the Spanish viceroys planned it, on a trunk road connecting Buenos Aires with Lima. Such Transandine lines as ascend from the Pacific shore, and even cross the Andes into the Amazon hinterland, will in that case become the feeders or the coast outlets of an international railroad system on the high plateaux in which Bolivia will form the central and most important section.

Reference:

1. Nictheroy–Parahyba Valley (Leopoldina R., Fribourg section).
2. Rio–Parahyba Valley (Leopoldina R., Theresopolis section).
3. Rio–Parahyba Valley (Central of Brazil R., North branch).
4. Rio–Parahyba Valley (Central of Brazil R., São Paulo branch).
5. Santos–São Paulo (São Paulo R.).
6. Paranagua–Curityba (São Paulo–Rio Grande R., Parana section).
7. São Francisco–Iguazu Valley (São Paulo–Rio Grande R., Sta. Catharina section).
8. Valparaiso–Mendoza (Argentine and Chilean Transandine Rys.).
9. Antofagasta–La Paz (Antofagasta and Bolivia R.).
10. Arica–La Paz (Arica–La Paz R.).
11. Mollendo–Lake Titicaca (Southern of Peru R.).
12. Lima–Oroya (Central of Peru R.).
13. Guayaquil–Quito (Guayaquil–Quito R.).
14. Bonaventura–Cali (Pacific (Colombia) R.).
15. Magdalena R.–Bogota (Girardot (National) R.).
16. Puerto Cabello–Valencia (Puerto Cabello–Valencia R.).
17. La Guaira–Caracas (La Guaira–Caracas R.).

GUAQUI PORT, LAKE TITICACA, BOLIVIA, AT SUNSET

SNOW-PACK AT 18,500 FEET, KINZA CRUZ, BOLIVIAN ANDES

PERU

Railroad expansion in Peru can normally proceed only in three directions. The first is along the desert coast from port to port, crossing numerous dry gulleys and a few irrigated valleys. The second location (roughly parallel to the coast) lies among the valleys and peaks of the high Andes which run from Lake Titicaca to Ecuador. The third, embracing the majority of Peruvian lines, comprises the various routes heading from the Pacific up the flanks of the coast Andes and also those which boldly attempt the crests of the high Cordillera. There are in addition many Transandine projects into the Amazon Valley, but for the present they remain mere projects.

The Pacific Coast Lines.—Peru's Pacific shore-line is 1400 miles long (about the distance from Buenos Aires to Magellan Straits), but its only real port—with the possible exception of Chimbote—is Callao, whose sheltered anchorage, just south of the fertile Rimac Valley, determined the location (some 12 miles inland) of Lima, the capital. This dual function of capital and port places Lima on the same footing as Buenos Aires and Rio, a noteworthy fact since the neighbouring capitals of La Paz, Quito, Bogotá, and Caracas are all set upon high plateaux overlooking the sea approach. Lima's unexpectedly cool climate is partly responsible for this choice, and partly the irrigation value of the lands tributary to the Rimac stream, which yields much of the food and other amenities necessary for the existence of the Peruvian capital. The chief centres of population in Peru do not lie behind the coast Cordillera, as in Bolivia, but mostly front upon the Pacific. The possession in this coast region of valuable guano and more recently discovered oil deposits, both important factors in the country's revenues, further promotes the seaboard population.

The Andes of Peru form an even more formidable barrier to the country's development than is the case in Bolivia. Moreover, the problem of surmounting the barrier is one that concerns Peru alone; no neighbouring state has any direct interest in assisting her. As in Bolivia, the fertile, *i.e.* the tropical, portion of the country faces the Amazon basin. Between this hinterland and the capital lying upon the barren Pacific coast lies a tangled mountain mass, through which there is no easy gateway. The only break in the coast Andes of Peru is at the Paita Pass (which will be later referred to) where the levels drop to 6500 feet, but elsewhere the Pacific coast passes vary between 14,000 and 15,000 feet. The inland or eastern Cordillera, on the contrary, is deeply eaten into by a network of waterways uniting in the rivers Ucayali, the Huallaga, and the Marañon itself, for northern Peru embraces the true headwaters of the Amazon, and 95 per cent. of the country's total drainage falls into its basin.

Although the line between Lima and Callao was the first to be completed on the Pacific coast (see Table F), Lima is to-day more out of touch with its provinces than any other South American capital, excepting possibly

Bogotá, in Colombia. There is of late, however, a tendency on the part of the isolated northern railways of Peru, built originally as transverse lines, to extend along the coast to Lima. The Lima–Huacho Railway (214 km.) is a concrete example of this coast-wise trend, while a line from Lima south to Pisco (246 km.), though not yet built, was actually surveyed as far back as 1864. Such coastal links will probably continue from time to time until they merge into a connected system joining Lima to all the more important northern and southern Peruvian ports, on somewhat the same plan as the Longitudinal Railway of Chile.

Everywhere along this seemingly desert coast the soil is intensely fertile under irrigation. Sugar-cane is cut throughout the year, while Peruvian coast cotton is considered equal to the best Egyptian. The heat radiating up from the desert strip appears to keep all clouds from crossing the Cordillera; occasionally, however, a cloud-burst comes over to the coast, and its erosive effect on the loose, porous soil is almost incredible. Although the interval between such phenomena averages five years, it fully explains the deep erosion to which the flanks of the hills facing the sea have been subjected, and which forms a further obstacle to the lines seeking to scale their flanks.

The Transverse Lines.—All the thirty railways officially recognized as separate companies in Peru originated on the coast, to carry produce from some irrigable valley to the nearest port. At distances from 20 to 100 km. inland, according to the bends of the coast and the sweep of the Cordillera, such lines begin to ascend the hill-slopes or river valleys, and the majority stop thereon, at heights varying from 2000 to 4000 feet. But like Napoleon's soldiers, each of whom carried a possible marshal's baton in his knapsack, every Peruvian railway, before it loses sight of the Pacific, is in the eyes of its promoters a potential Transandine, if not a Transcontinental system. The more ambitious lines, politically supported or tempted by mining prospects, thus obtain concessions granting them the barren privilege of attempting the appalling slopes ahead.

When we remember the enormous cost and the engineering difficulties overcome by the seven lines which at this date have alone succeeded in scaling the coast Andes, in the 4000 miles lying between Puerto Montt in Southern Chile and Panama, it is not surprising that in Peru only two transverse lines, the *Central* and the *Southern*, should have realized this ambition. Construction on the Central Railway commenced in 1870, but not until 1893 was it completed to Oroya, a distributing centre on the plateau, about 30 km. beyond the coast summit. The line was a prolongation of the original Callao-Lima Railway, a rash acceptance of the tempting invitation to ascend the valley of the Rimac River, which makes a straightforward plunge here from the snows of the Andes to the Pacific shore. The construction of the Central line includes sixty-five tunnels and sixty-seven viaducts. Though both daring and picturesque it presents serious drawbacks in operation, and a much better, even if less picturesque and

longer, line could have been found by surveying the Andean approaches and passes a little further north. Like the majority of Peruvian roads, the Central is built to the standard (4 feet 8½ inches) gauge, a fact in itself sufficient to disprove the South American fallacy that only "narrow-gauge" lines are adaptable to mountain grades. Passenger trains ascend in eight hours the 150 km. from Lima (500 feet above sea-level) to the summit tunnel at 15,665 feet. The Rimac Valley narrows so steeply between its confining head-walls as to preclude any development even by using the uniform 4 per cent. gradient, and in such emergency the railway side-steps up the hillside in a series of "V" switchbacks. Before entering the summit tunnel a short branch line departs overhead among the glaciers to an altitude of 15,865 feet, serving the copper-mining camp of Morococha. Thus the Peruvian Central Railway can claim the somewhat barren honour of operating the highest railway in the world, though the Antofagasta and Bolivia Railway operates two branches, *i.e.* to Collahuasi and Potosi, whose tracks come to within a few feet only of this great altitude.

The Southern Railway of Peru, which starts from Mollendo port—or rather breakwater, for Mollendo lies in an open roadstead—has already been noticed (*vide* Bolivia) as one of the three coast railways leading to La Paz. Transandine lines, both in Peru and Bolivia, in addition to fuel difficulties on the high plateau, have to face an excess of outward over inward freights, sometimes as high as six to one. That is to say, for every six full train-loads despatched to the coast five empty trains must be hauled up the hill. This disadvantage is chiefly owing to the low standard of living of the Indians who form the bulk of the population. But it is much easier to criticize from a distance the operating results of these adventurous lines, than to recognize at its proper value their stimulating effect on the countries set astride the great Andes of the north-west Pacific shore. Especially valuable are the opportunities they grant to such travellers as desire to visit within a reasonable time-limit one of the most historic, picturesque, and interesting regions of the two Americas. When the present war is ended and the Panama Canal in full working order, this section of the southern continent will attract, thanks to their pioneer work, a far wider and more intelligent interest than it has heretofore enjoyed, not only from foreigners but also from the citizens of other South American Republics.

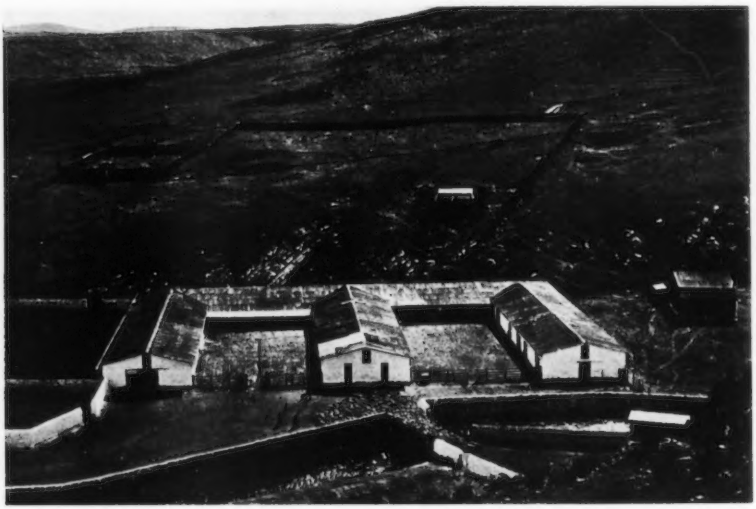
Peru has many interesting Transandine projects, notably the line over the Paita Pass in the north, where the Andes drop to 6500 feet. The lowness of the gap at this point is counterbalanced, however, by the fact that in order to reach Amazon navigation from the coast two inland ranges of almost equal height must be crossed, making the total of mountain construction equal to that at any other point. Another project is the prolongation of the Chimbote line up the fertile valley of the Rio Santa, which cuts the coast range. Even if the railway negotiated the coast gorge it would be confronted by the inland Andes before reaching the Marañon

river. This, the true headwaters of the Amazon, runs north and parallel to the coast for 300 miles before it breaks through the final defile, or "Pongo," of Manseriche, and so unites with the main Amazon stream. The construction of these and similar Transandine projects in Peru will necessarily depend on the results shown by the railways already partially traversing the Cordilleras. Existing lines which have already scaled the coast range of the Andes will certainly be in a position to attempt the yet more difficult Amazon slopes, long before those constructions still halting near the Pacific coast, whose advance, however desirable, it is beyond the present power of the Government to assist.

Altaplanicie Lines.—There are only two short extensions of railway on the Peruvian tablelands, both worked by the Peruvian Corporation as a part of its Transandine lines. The first is the branch of the Southern of Peru Railway (already noticed), running from Juliaca junction to Cuzco. This line crosses at La Raya Pass (14,536 feet) the Sierra of Vilcanota, which forms the northern dam of Lake Titicaca and the Bolivian lacustrine basins to the south. Further north, along the Altaplanicie, the Central Railway, reaching Oroya by the Rimac Valley, branches T-shape among the Andean plateaux. One arm comes 120 km. south to Huancayo, and is under construction a further 180 km. due south to Ayacucho. From Ayacucho a prolongation to Cuzco would involve, according to preliminary surveys, another 500 km., though it appears improbable that any railway should wish to negotiate the wild and desolate gorges of the Apurimac river, lying directly between these two points. In highly mineralized countries like Peru or Bolivia, however, there is always the possibility of some mining railway contradicting conclusions based only on the topographical surveys of any given region. Mining railways cannot have their routes foretold or classified, since their construction depends on calculations as to the life and possible value of a mine, set against the cost of transport. Thus when a mining railway coincides with any other railway programme, it is usually more from chance than of set purpose. An example is the second or northward arm of the Central Railway from Oroya to the Cerro de Pasco copper-mines (110 km.). After traversing the Juan Pampa, a plain of historic interest where Simon Bolivar, the founder of Peruvian and Bolivian Independence, defeated the Spaniards on 6 August 1824, this branch ends at the large Cerro de Pasco works and smelters, under American management, whose output is an important traffic item on the Central Railway. The mine-owners, having thus succeeded in bringing the Central Railway up to their property, now project a further extension on their own account down the eastern slopes of the Cordillera to a navigable point on the Ucayali river, whence shallow-draught steamers can proceed down the Amazon. This extension, as at present planned, would descend abruptly by a narrow-gauge line from Cerro de Pasco for 90 km. on 5 per cent. gradients, through the valleys of the Tinga and Huallaga, till it reached the Ucayali

CENTRAL OF PERU RAILWAY, "V" SWITCHBACKS IN RIMAC VALLEY

CENTRAL OF PERU RAILWAY, AYACUCHO VALLEY, 10,500 FEET



MESSRS. DUNCAN, FOX & CO.'S SHEEP RANCH IN THE PERUVIAN ANDES

river. After much activity in early surveys and concessions, the project now seems to be in abeyance.

Another example of mining activity aiding transport on the Peruvian plateau is the highway (not a railway), 200 km. long, built by the Inca Mining Company from Tirapata station on the Cuzco branch, down to the Inambaru gold district on the Upper Madre de Dios river, opening up a rich but frightfully broken country. Again, the discovery of large copper deposits at Ferrobamba, near the headwaters of the Apurimac, lately led to surveys for a railway following the plateau contours for 240 km. to a junction with the Southern line. An alternative survey was also made for a line direct to the coast, which could of course only be built at the sacrifice of the plateau line referred to. Both these projects have for the time being also fallen into abeyance. Thus while mining will probably form the principal basis for new railway constructions on the Peruvian highlands, no forecast can be made as to their location. The future Andean railways of Peru may lie to-day in the womb of any of her big hills.

Apart from the more spectacular mining industry, it is well to note that the plateau and the limestone flanks of the high inland Andes of Peru are already grazed by thousands of llamas, as well as by scattered flocks of native sheep, for which the short turf that grows from 11,000 feet up to the snow-line is admirably adapted. An interesting and successful experiment has been carried out by Messrs. Duncan Fox, who ten years ago imported 6000 well-bred sheep from the Straits of Magellan to form the nucleus of an Andean sheep-breeding industry on modern lines. The flocks have now increased to over 40,000 under the care of Scotch shepherds brought from the Orkneys, the whole undertaking reflecting great credit on Anglo-South American pastoral enterprise. We have the analogy of Patagonia to prove that wherever the guanaco runs—to which the llama and vicuna are first cousins—it is a sign of good "sheep country," and the logical inference is that 2000 miles of the Andean Cordillera in Ecuador, Peru, and Bolivia offer for sheep-breeding a region greater in area even if somewhat inferior in grazing quality to that of all Patagonia—a very interesting reflection. The comparative mobility of flocks on the high Andes will not directly call for railways, as does the mining industry, but any improvement in their quality will at once be reflected in the status of the landed proprietor as well as by a higher standard of living for the native Indian peasant-cultivator, on whom eventually progress in Peru mainly depends.

Peruvian Waterways.—In any discussion of Peruvian routes, we must not forget that most of its eastern hinterland is readily accessible through the tributaries and headwaters of the Amazon, once the river gorges of the "Montaña" country are passed. Twenty great streams within Eastern Peru have been surveyed to give over 7000 miles of navigation. Peru's chief Amazon port, Iquitos, 2000 miles up-river from Para, is visited by

ocean vessels of six thousand tons, and Amazon navigation extends from the Atlantic to a point only 300 miles in direct distance from the Peruvian coast. That is to say, seven-eighths of the distance lying between the Atlantic coast and the Pacific port of Callao can be traversed by river. Yet immovably blocking the access from Lima to these inland regions and the tempting Atlantic waterways rises the rocky mass of the Andes, and foreigners can at least sympathize with the feelings of helpless impatience, not unmixed with native pride, with which Peruvians contemplate that enormous barrier. Since March 1910 mails have been sent from Iquitos to Lima by a combined service of shallow-draught steamers up to the limit of Amazon navigation, whence connection is made by mule-train and carriers over the inland Cordillera to Oroya, and so down to the Pacific coast by the Central Railway. The service from Iquitos to Lima is scheduled at thirty-three days, but may be delayed by weather conditions up to fifty days, illustrating well the difficult nature of the country to be traversed.

The set-back given to Peru by her disastrous war with Chile arrested for an indefinite period any really constructive State Railway policy. Still, sooner or later (but more probably late than soon), the gap now separating the Central Railway from the Southern Peruvian Transandine systems will be closed, either upon the plateau or along the coast. At such time Lima, even if still separated from her provinces within the inaccessible Amazon basin, will then gain a fresh impetus, as the Pacific coast terminus of an international service passing through La Paz down to Buenos Aires.

TABLE F.

First Railway Constructions in South America.

	From	*To*	*Distance in km.*	*Gauge.*	*Construction Begun.*	*Finished.*	*Remarks.*
Peru ...	Callao	Lima	14	4 ft. 8½ ins.	June 1850	April 1851	Engine ran on 5 km. June 1850.
Chile ...	Caldera	Copiapo	81	4 ft. 8½ ins.	March 1850	Dec. 1851	Section Caldera–Algarrobo finished Sept. 1851.
Brazil ...	Rio Bay, Maña	Raiz de Serra	16·2	1·67 m.	April 1853	Dec. 1856	(F.C. de Maña) 14·5 km. finished April 1845 to Frajoso.
Argentine	Buenos Aires	Merlo (approx.)	23	5 ft. 6 ins.	Feb. 1855	Aug. 1857	In 1860 there were 39 km. of line on a single railway. Capital, $741,000 gold.
British Guiana	Georgetown	Plaisance	8·04	4 ft. 8½ ins.	1847	1848	Construction recommenced 1851.

Before leaving Peru we may settle a small but interesting historical detail. Both Chile and Peru claim the distinction of having built "el primer ferrocarril Sud-Americano," and the subject is often debated in the railway press of these and other countries [see preamble to 'Argentine Boletín de Obras Públicas.' Sección Técnica. Nov. 1911]. The confusion appears to lie in whether the definition of a "railway" depends—(1) on the completion of the original project, or (2) on the opening of any section of the same; and in this case (3) whether the line in British Guiana counts as "South American," since it so obviously anticipated both claimants! Table F will show the facts regarding actual construction. Dates of their concessions, etc., which in most cases were granted several years earlier, are ignored.

ECUADOR

Of the 644 km. of Ecuador's entire railway system in 1914,* 464 km. are accounted for by the Guayaquil-Quito line running between the port and the capital. Ecuador, like Paraguay, has practically only one railway.

Although the Republic is thus backward in railway mileage, its position and its topography furnish an excellent excuse. The parallel Cordilleras of the Andes contract within Ecuador to virtually a single range, or at best a twin range, enclosing the narrow valley in which stands Quito and every other important city outside Guayaquil. North of the Quito plain the range again contracts into the Knot or "Nudo" of Pasto, before it opens out into the three Cordilleras which traverse Colombia. The Ecuadorean Andes form a narrow, broken and lofty mass, which is highly volcanic, including many well-known active cones, such as Chimborazo and Cotopaxi. The flanks overlooking the Amazon Valley are excessively steep, and practically preclude any economical railway construction on this side, now or in the future. From the high plateau not even a mule track descends the Eastern Andes of Eucador, and it is with extreme difficulty that an active man on foot, assisted by Indian guides, can make the descent from Quito to the River Napo, the nearest Amazon tributary. Connection with the Amazon basin, however, is of less importance to Quito than to Lima or La Paz. Ecuador, with north-west Colombia, possesses the only portion of the Pacific coast of South America whose conditions parallel the tropical shores of Brazil. The Humboldt current strikes the Pacific coast at Tambez, just south of the Gulf of Guayaquil, where its moisture-bearing influence is seen in the abrupt change from the arid Peruvian shore-line to dense massed vegetation. The heavy rainfall which prevails from Guayaquil to Panama, has broken the coast range here into a succession of rugged and jungle-covered hills, easily accessible through numerous ports, into which fall short torrential rivers.

* "Reviewing the railway situation, 53½ km. of line have been completed during 1915–16, and 116 km. surveyed, while plans relating to a further 702 km. are under consideration by the Department of Public Works" (Message of the President at opening of Congress, from the 'Registro Oficial (Quito),' 11 August 1916).

The most important of these, the Guayas river, debouches into the Gulf of Guayaquil. Though its estuary is somewhat impeded by sandbanks, this river harbour affords good and sheltered anchorage, and through it passes 90 per cent. of the country's imports and 80 per cent. of its exports.

Guayaquil had as bad a reputation for yellow fever as formerly had Santos, Rio Janeiro, La Guaira, Panama, and Havana. The Panama Canal Commission, recognizing the serious nature of this danger so close to a new gateway of the world's shipping, submitted a project for the sanitation of Guayaquil port, and a part of the scheme has already been put in hand. The completion of the programme will tend to further focus the country's transport upon the Quito-Guayaquil railway and port, so that it will henceforward be practically impossible, even if it were desirable, to give it a different trend.

The Guayaquil-Quito Railway, which is of 3 feet 6 inch gauge, starts from the Duran landing on the Guayas River, opposite Guayaquil. It is proposed to connect Duran and Guayaquil by a bridge, but at present passengers and goods are conveyed by ferry from the port to the railway terminus. After traversing 87 km. of delta lands the line begins to climb the Andes, and during the next 80 km., using 5 per cent. maximum gradients on a plain adhesion track, attains an altitude of 10,626 feet. The highest elevation of 11,841 feet is reached at km. 275, but the line continues rising and falling between altitudes of 8000 and 11,000 feet, until it debouches on the Quito plateau (9375 feet). The railway is one of the most interesting examples of mountain engineering in South America, the "Alausi Loop" and the "Devil's Nose" double zigzag being especially notable. The last-named section involves the use of a "V" switchback, similar to those employed on the Central of Peru Railway. The ascent opens up some of the finest scenery in the Ecuadorean Andes, Chimborazo and Cotopaxi volcanoes being passed close to the west, their summits high above the snow-line.

Although the Guayaquil–Quito Railway was only completed in 1908 its first concessions date from 1872, and the history of the line is practically an epitome of the progress of Ecuador during the intervening period. An extension is planned from Quito north to Ibarra, towards the Colombian border, and also from Guayaquil to Playas, a port on the Gulf outside the Guayas river bar, and there is little doubt that both these projects will be carried out.

For the present the Guayaquil–Quito Railway serves, and indeed, has anticipated, the chief needs of Ecuador for years to come. The plateau portion of the line is an important link in the much-advertised project of a through railway from New York to Buenos Aires, which under the pretentious title of the "Pan-American" Railway has gone to some expense in making sporadic surveys here and in other parts of South America. Any engineer with even an elementary knowledge of Ecuador's geography, as well as of the physical difficulties facing an extension of the Guayaquil-

Quito road either north or south, must be very doubtful of the practical advantages of this scheme. Meantime there is no good reason, political or economic, to suppose that the railroad system of Ecuador will be employed otherwise than in concentrating all the energy and trade of the Republic upon its existing outlets to the Pacific coast.

COLOMBIA

Although Colombia is the only country in South America whose coast-line faces to both the Atlantic and the Pacific, the three great Cordilleras which split it from south to north, and the position of Bogotá, the capital, in their midst, make this possession an embarrassment rather than an asset in solving her transport problems. Of the dozen or more railways open to public traffic, no single line exceeds 136 km. in length, a fact which is in itself eloquent of Colombia's complex topography.

Most Colombian railways are designed as links with the Magdalena River, which traverses the heart of the land between its attendant mountain ranges. The stream is navigable by shallow-draught steamers for over 1120 km. from the Caribbean, although its course is broken halfway by the impassable Honda Rapids. This invitation of an easy fluvial passage to Colombia's interior by the Magdalena is, however, more apparent than real. The river is bordered in its lower reaches by extensive marshes draining from broken, forest-clad hills, while its upper stream leads straight into a mountainous "cul de sac" culminating in the Nudo de Pasto of the Ecuadorean Andes. There is little settlement on the banks of either its upper or lower stream, for Colombia's chief products come from remote secondary valleys, or are grown on high plateaux. The exclusive use of the Magdalena approach has, moreover, resulted in almost entire neglect of the lands in the Amazon and Orinoco basins, comprising three-fifths of Colombia's whole area, which remain to-day unmapped and uninhabited save by a few rubber traders and Indians. One of the few inland frontiers still disputed in South America lies in the north-west corner of the Amazon Valley, where these neglected hinterlands of Brazil, Peru, Colombia, and Venezuela meet.

All populated Colombia thus lies on a triple cordon of the Andes, which, breaking out from Ecuador, spreads north through the Republic like the ribs of a half-open fan. The lowest passes of the Pacific Cordillera are 3000 feet above sea-level. This, together with the coast, forms the Pacific section of Colombia.

The Magdalena Valley between the central and the eastern ranges, at a point opposite Bogotá, is 7000 to 5000 feet below plateau levels or mountain passes on either hand. The passes leading out of the Magdalena Valley are lower when downstream, higher—almost impassable—upstream. Such is Colombia's Central and chief transport zone.

The Cordillera running east of Bogotá, including that splendid outlier the Sierras of Santa Marta, whose five snow-capped peaks, over 19,000 feet high, marked the Magdalena entrance to early explorers, defines a third

zone, equally apart from the rest. A distinctive feature of this Eastern Cordillera, the highest of the three ranges, are its grassy highlands, occurring from 7000 feet upwards. These savannahs, or "sabanas," are the remains of an ancient plateau, now heavily eroded by tropical rain, and with its deep-cut valleys smothered in tropical forest. Part of this eastern country joins the Venezuelan frontier, where the natural outlet to ocean is through that Republic by the Gulf of Maracaibo, a political factor which has considerably affected its past development.

Split by these great mountain masses into a series of roughly parallel south-and-north zones, no country in South America has made greater sacrifices than Colombia, not only to unite its provinces by an interior railway system with Bogotá, but to ensure to each province, by rail or river, its ocean outlet. The difficulties in the way have proved enormous. Bogotá stands 8563 feet high upon one of the saucer-like eastern savannahs mentioned, about 150 km. east of and 1200 km. upstream from the Magdalena delta. Any western railway that connects the capital with the Pacific coast will thus resemble a gigantic switchback, with five separate descents and rises ranging from 7000 to 3000 feet each. Constructions eastward are limited by Venezuela's control of the Gulf of Maracaibo. While these more settled portions of the Republic are yet insufficiently served, Colombia's territory in the Amazon basin will remain, like that of her neighbours, untouched by the railroad for long years to come.

The bulk of imports and exports in Colombia both comes and goes by way of the Magdalena River, excepting always the local banana traffic direct to the Caribbean of Santa Marta port. The railways which at different points throughout its course link Bogotá with the Delta, are an earnest of the nation's choice of this as their permanent and main passage to the outside world. Colombia's capital city is more remote to modern travel than any other South American capital, about a week being employed on the inward trip by the Magdalena, and five days to return. As all ordinary travellers, in addition to goods, must approach and leave Bogotá by this route (unless they venture on mule-back over the mountains), a detail of the various stages may be usefully given here. In all five changes are made, viz.—

Route from Ocean to Bogotá, Colombia.

		Length of sections in km.
Savanilla Bay to Barranquilla (Magdalena River)	Barranquilla Railway, 1 metre gauge	37
Barranquilla to Dorada	Colombia River Navigation Co.	about 864
Dorada to Ambalema	La Dorada Railway, 3 feet gauge	111
Ambalema to Girardot	Colombia River Navigation Co.	about 70
Girardot to Facatativa	Colombian National Railway, 3 feet gauge	132
Facatativa to Bogotá	La Sabana (State) Railway, 1 m. gauge	40
	Total, Barranquilla to Bogotá	1,254 km.

If the journey is begun from Cartagena port, the distance remains almost the same, an additional 71 km. on the Cartagena Railway being balanced by a similar deduction from the river trip.

A separate examination of these links in Colombia's sole highway to the ocean will best enable us to gauge their relative value.

The Barranquilla Railway connects Savanilla Bay, on the Caribbean coast west of the Delta, with the small port of Barranquilla from which it takes its title, situated at the lowest stage downstream on the Magdalena River proper. The line avoids the dangerous bar and shifting sandbanks which mask the river's outlet to the Caribbean, and thus affords incidentally one of the best examples in South America of combined rail and river transport work. The Barranquilla was Colombia's first railway, commenced in 1867. No line has played a more useful part in developing Colombian commerce, and it still carries about 70 per cent. of the total tonnage handled at all Atlantic ports (save Santa Marta) for the interior.

The Cartagena Railway serves the same purpose as the Barranquilla line, but crosses from the coast to the Magdalena River higher above the Delta. In addition to its railway the company operates a fleet of thirty-two river steamers, touching at some fifty small ports and landing-stages on the Lower and Upper Magdalena. Cartagena, its railway terminus and ocean port, was prominent even in early colonial days not only on account of its fine natural harbour, but by reason of a canal 132 km. long, engineered by the early Spaniards between the port and the Magdalena. Cartagena was thus enabled for two hundred years to control the entry to the whole Magdalena Valley, in addition to being the chief *entrepôt*, on the Atlantic side, for the trade which crossed by Panama from the Pacific coast. After Colombia's independence was declared the canal, whose course is still visible in a series of shallow lagoons, was allowed to silt up. When in later days the Barranquilla Railway was built, the population of the once-famous port had fallen from 30,000 to 8000, an interesting example of the dependence of South American cities on transport routes, which are essential to their permanent growth.

The *Dorada Railway*, built round the Honda Rapids of the river, forms the connecting link between navigation on the Lower and Upper Magdalene. It therefore of necessity handles all imports and exports for Bogotá and for the interior country above the rapids. Operated by an English company, it lies on the left bank of the river and is the best maintained and equipped line in Colombia. The railway has the right of extending from its present up-river terminus at Ambalema to a point opposite Girardot, the gap of 60 or 70 km. being at present covered by the river steamers of the Carthagena Company. In the event of the Doradá line linking up with the Girardot railway and so providing through railway connection between the lower river and Bogotá, it would still be necessary to first build a bridge over the Magdalena river, in itself a formidable undertaking. Periods of low water, which already interrupt

traffic on the Upper Magdalena, have a marked tendency to recur as forests are denuded or burnt near the headwaters of the river, and the rail extension from Ambalema to Girardot thus tends to grow more urgent each year. From Mariquita station, where the line curves inland past the rapids, an aerial railway, or ropeway, has been constructed to Manizales, a fertile coffee and mining centre lying among the hills 64 km. due west of the line. The only other aerial railway, to my knowledge, open to public traffic in South America, is that serving the Famatima copper-mines in the province of Catamarca (Argentine). The success achieved through the construction of similar overhead cableways, officially known as "Telleferica" by the Italian Army in their present campaign against Austrian troops among the Dolomite Alps, may later lead to an extension of their use in South America. Such lines are not of course best suited for passengers, but by their relative cheapness, direct access, and quick construction they would help to secure mining and other traffics equally essential to the prosperity of many a struggling enterprise among the Andes.

The Colombian National Railway, known locally as the Girardot Railway, runs from Girardot port on the Upper Magdalena (altitude 1066 feet) to Facatativa (8576 feet) on the western edge of the Bogotá savannah, thus rising 7510 feet in 132 km. The maximum gradient is 4 per cent. and no racks are used. Though not situated on the sea-coast, the Girardot Railway falls into that category of politico-mountain railways giving an ocean outlet to the capital city, which includes the La Guaira–Caracas Railway of Venezuela, the Arica–La Pas Railway of Bolivia, and the Guayaquil–Quito Railway of Ecuador. Construction on the Girardot line began in 1880, but faulty surveys, political troubles, and lack of funds delayed its completion for twenty-seven years, until August 1909. At one difficult period the Government lent military aid to carry on construction, and though registered as an English company the line has always been recognized as a National rather than a private enterprise, as its name implies. The total cost to the Government has been over £1,500,000, but the result has been to barely establish the rail connection. Before the line can bear heavy and continuous traffic it will practically have to be rebuilt.

La Sabana Railway.—This last link in the long chain from the Delta to Bogotá merely covers the 40 km. of flat savannah which separates the capital from the steep edge overlooking the Magdalena valley. Apart from this, the Sabana Railway is noteworthy as having been built and operated on the Bogotá plateau long before the Girardot railway was complete. This amazing feat was accomplished by carrying all the heavy railroad material, including rolling stock, by cart and on mule-back up from the Magdalena River by a road specially constructed from Cambao port (opposite Ambelema) to the plateau. The expense of this rough mountain road was £7500 per kilometre—equal to that of a first-class,

well-ballasted, broad-gauge railway near Buenos Aires. As if to perpetuate its early independence the Sabana line, being of 1 metre gauge, obliges all goods for Bogotá brought up the 3-feet Girardot Railway to be re-handled at Facatativa.

The Cauca, or Pacific Railway, will connect Buenaventura, the chief Pacific port of Colombia (410 miles south of Panama), with the valley of the Cauca river. This line represents the first stage in an ambitious project for joining Bogotá to the Pacific coast. The Cauca valley, its immediate objective, is fertile and well settled; its mining industry achieved in 1915 a gold recovery totalling close on a million sterling. The Pacific Railway was started in 1876; but after a lapse of thirty-one years only 55 km. had been built, including a bridge connecting Buenaventura Island with the mainland. Here, as with the Girardot line, owing to unsettled conditions and interrupted construction the loss of time, energy and money was enormous, and the total cost to Colombia of these 65 km. is around £1,000,000. In spite of this outlay the line fell into dangerous disrepair. A frank statement by the Ministry of Public Works in 1912 adduces, as a proof of improved conditions, that whereas in 1910 there were 162 derailments on the line, in the succeeding year derailments fell to only 70. The distance from Buenaventura to Cali, the present inland terminal situated on the Cauca river, is 125 km., the coast Cordillera being crossed at 5216 feet by the Cresta de Gallo Pass. Shortly after construction reached this point in 1913 violent rainstorms washed away large portions of the newly-built track, which however has since been repaired. The rail altitude at Cali, within the valley, drops to 3300 feet.

Stress has elsewhere been laid on the immense difficulties that attend all railway building in the rainy tropics of South America. Colombia's costly attempts at mountain railway construction call for careful study rather than cheap criticism. The lessons they bring home for our guidance in future work here and elsewhere are (1) to estimate liberally for *unforeseen* difficulties; (2) to make full provision of funds, material, and labour before starting; and (3) having started, to push the construction to a close with the maximum energy and in the shortest time possible. Nature when waging warfare is more implacable than man, and in these isolated regions of the Southern Continent the silent struggle is unequal and unceasing.

VENEZUELA

Although an eastern counterfort of the Andes projects upon its coast and its southern frontier touches the water-parting of the Amazon, the major part of Venezuela's internal transport system is safely beyond the control of these two dominant factors in South American geography. In other respects this northernmost of the Republic presents us with a small-scale replica of Brazil. A coast plateau presents its abrupt cliffs to the sea. A shore-line clothed in dense vegetation reveals unexpected harbours.

Its western watergate, the Orinoco, is divided into an upper and a lower basin and offers 1200 miles of river navigation from the Atlantic, with vast plains and savannahs stretching on either hand. Yet though nearest to Europe of all South American Republics and having attracted to its territory in consequence more than its share of early exploration * and settlement, Venezuela, with over 1,000,000 square km. of territory and nearly 3,000,000 inhabitants, can to-day show only 938 km. of railway.

The early founding of Caracas, on the coast plateau at 2984 feet altitude, overlooking La Guaira port, also definitely fixed upon the Caribbean coast the later political control of the Republic. The effect of this control has been disproportionately marked. All settlement is concentrated north of the Orinoco basin, within a zone nowhere over 150 miles from the coast, and every kilometre of railway in the country lies on this narrow strip of territory, leaving the 370,000 square miles within the Orinoco basin practically undeveloped. Venezuela's present transport service is not only inadequate to the needs and resources of the country; it both unbalances and accentuates an uneven development. The position of Caracas made a rail connection with La Guaira port the first necessity, its costly construction being later duplicated by the Puerto Cabello–Valencia line further west. Constructions upon the Caribbean coast naturally followed the river valleys as much for the sake of gradients as to serve existing settlements along these valleys. In a country of heavy rainfall this led to abnormal expense in bridge work. On the 938 km. of track in Venezuela there are over seven hundred bridges, and this heavy expense again helped further to exhaust the resources available by Government to aid new constructions. Some twelve years ago Congress recognized the unsatisfactory position by passing its first railroad law. This hastily coded statute had the undesigned effect of stopping all new construction, and has since been drastically revised. It had however one good point, viz. the limitation of all new lines to a uniform 3 feet 6 inch gauge. The only other South American state which legally enforces a uniform gauge is Bolivia, where the ruling standard is 1 metre.

Just as in Brazil the loop of line connecting Rio and Santos ports is from every viewpoint the most important in the country, so the similar loop from La Guaira to Caracas, across the Valencia plateau and down again to Puerto Cabello, is Venezuela's key-system. It has the added advantage

* *Vide* "The Discoverie of the large, rich and bewtiful Empire of Guiana, with a relation of the Great and Golden City of Manoa (which the Spaniards call El Dorado) And the prouinces of Emeria, Arromaia, Amapaia, and other Countries, with their riuers, adioyning. Performed in the yeare 1595, by Sir W. Ralegh, Knight" (Hakluyt Society Edition, 1848). The Guianas to which Raleigh referred were of course the southern highlands overlooking the valley of the Lower Orinoco. His entry to the river was effected by the "Bocas Chicas" or western mouths of the Delta, which are only 30 miles distant from the shores of the British Crown colony of Trinidad.

of epitomizing for the traveller in the space of a short and convenient trip, certain picturesque aspects of South America which elsewhere would take him several weeks to encounter.

La Guaira–Caracas Railway.—Although the distance between the historic port of La Guaira and the capital city is only 11 km. as the crow flies, the railway develops a total length of 36½ km. in order to climb the abrupt scarp of the plateau, which it achieves on a maximum 4 per cent. grade without the use of racks. The line ranks high both in interest and utility among the other remarkable coast-to-mountain railways of South America. Like the Paranagua–Curytiba line in Brazil, it skirts in the ascent an abyss varying up to 1000 feet in depth, whence magnificent coast views are obtained. The highest altitude (3320 feet) is reached just before the descent to Caracas. The railroad was commenced in 1880, and construction finished in 1883, a fact greatly to the credit of the English Company which operates it.

The Great Venezuelan Railway acts as the connecting link along the coast plateau between the two port lines of La Guaira and Puerto Cabello. The line traverses a very broken country and its 179 km. include 219 bridges and 86 tunnels, thanks to which it keeps within a 2 per cent. maximum gradient. This is one of the best built and maintained lines in Venezuela, and carries more passengers than any other, a further proof of the concentrated settlement on this coast plateau. Through its eastern and western terminals at Caracas and Valencia it feeds the La Guaira and the Cabello port lines, though traffic destined for the former is handicapped by the break from 3½ feet to 3 feet gauge. The Great Venezuelan Railway was built and is to-day operated by a German company, whose control is in Berlin. The only other railway (a term which does not include suburban and city tramlines) in South America in German hands is a line in Sta. Catharina (South Brazil), leading inland from Blumenau. It is significant of the interest taken by the German Government in the business engagements of its overseas citizens in South America, that when the contract for the Blumenau railway was concluded, Emperor William II. presented a signed portrait of himself to the German minister who helped to negotiate it. Again, in Venezuela when in 1897 serious differences arose between the promoters of the Great Venezuelan Railway and President Castro's Government, German warships were ordered to Caracas to try and force a settlement.

The Puerto Cabello and Valencia Railway starts, as its name indicates, from Puerto Cabello (a sheltered harbour 120 miles west of La Guaira), and after a short coast run turns up the valley of the Aguacaliente river and reaches La Entrada (1952 feet), climbing 1730 feet in 15 km. A maximum gradient of 8 per cent. for 4 km. when approaching La Entrada is surmounted by rack-rail.

Western and Frontier Lines.—The oldest railway in Venezuela is the Bolivar (176 km.) from Tucacas port to the rich copper-mines of Aroa.

In its final ascent to the mines the railway negotiates 2 km. of 5·27 per cent. gradient on an ordinary adhesion track.

Several short lines serve the Maracaibo district, which has much increased in importance owing to recent discoveries of oil. Maracaibo Lake—as large as Lake Erie—lies on the extreme western front of the Republic, which is hemmed in by the Colombian Andes. The Lake connects through a narrow sea-channel with Maracaibo Gulf, and forms the only natural ocean outlet for all lines lying within this last fork of the Andean ranges.

Here also we find the *Tachira Railway* (115 km.), which in a commendable spirit of economy begins some 50 km. up the navigable Catatumbo river, skirting the Colombian frontier. *The Cucuta Railway* in Colombia (71 km.), which is completely shut off by the Eastern Colombian Andes from the rest of that Republic and depends entirely on its Venezuelan outlet, also connects with Maracaibo navigation at Encontrados, near the junction of the Catatumbo and the Zulia streams. The two frontier railways are not yet joined up, though a link of about 20 km. would not only obviate river delays on the upper Zulia, but inaugurate the first and only international railway service likely to operate out of Colombia or Venezuela. By pure coincidence both railways are also built to the same gauge, viz. 1 metre.

The Orinoco Basin.—The most obvious lack in Venezuela is a railway leading from Caracas due south over the coast hills and down to the Orinoco River. A start of 66 km. in this direction has been made by the Venezuelan Central Railway, but being operated by a private company its means are too limited to undertake extensive pioneer work through an undeveloped country, whose only present industry consists of vast cattle ranges. Properly backed by the Venezuelan Government, a trunk railway to the Orinoco, short-circuiting the present roundabout sea and river route *viâ* its Delta, would have the same effect on the whole neglected Orinoco basin that a ventilating shaft has on a closed mine.

The Orinoco must in the end always exercise a major influence upon Venezuelan transport. Too great to be bridged, its navigable reaches, like those of the Amazon, will have to be combined with and by the railway. Torrential rains cause the main river to rise at times 30 feet, and in the narrower passages 50 feet, but these variations somewhat counteract the difficulties of the passage for large vessels trading within the Delta channels, where the river's minimum depth, according to season, varies from 10 to 15 feet.

As the Orinoco leaves its upper basin it drops through 6 miles of rapids known as the Raudales de Atures. The building of a short loop line here, linking traffic on the upper with that of the lower river, would have the same relative strategic value to this Guiana hinterland* as the

* The expression is here used in its wider sense of water-parting with the Amazon basin.

Madeira–Mamoré Railway has to the Madeira watershed of Eastern Bolivia and the lower Amazon River. At the extreme limit of the Orinoco, on the Brazilian frontier, the catchment phenomenon known as the Cassiquiare Canal permanently unites the headwaters of the Orinoco to those of the Amazon *viâ* the Rio Negro.* Allowing, therefore, for portage round the Raudales de Atures rapids, continuous river navigation is feasible from Bolivar town on the Orinoco to Pará at the entrance to the Amazon, a distance of over 2500 miles.

Studying these immense inland waterways we find that a combined rail and river route, joining Caracas to Buenos Aires, is not outside the limits of possible transit. Apart from any local advantage, such a system would at least demonstrate that most remarkable and much-neglected feature of South American geography, namely, the continuous and low-level river-basins which run through the heart of the Continent. It would be possible to traverse on an inland voyage from Bolivar (Lower Orinoco) to Buenos Aires over 6000 km. of continuous though tortuous river navigation, by utilizing only three link railways, totalling between them 900 km. These links would be, first, the Raudales de Atures portage; second, the Madeira–Mamoré Railway (already built); and third, a further line (already surveyed) from Santa Cruz, the head of navigation on the Mamoré (Bolivia) river, to Corumba, the Brazilian port on the Alto Paraguay. If we add to these the Caracas–Orinoco valley railway construction here recommended we obtain, by the simple and fascinating process of drawing thick lines on a small-scale map, a Transcontinental north-and-south, rail-and-river system at least equal in interest, and with as much likelihood of being carried to completion, as most of the Transandine and Transcontinental concessions which are so light-heartedly applied for and granted throughout tropical South America.

THE GUIANAS

British, French and Dutch Guianas are the only foreign-owned territory—unless we include the Falkland Islands—on South American soil. They resemble a tropical island flung against the north-east shore of South America. Were the continent to be submerged 1000 feet, they would look across the encircling floods of the Orinoco and the Amazon basins to the outlying Andes and the plateaux of Central Brazil. Indeed, the Colonial policy which governs the fortunes of these European dependencies is already as divorced from the ideals of the South American Republics as if some such cataclysm had actually occurred.

British Guiana, the largest of the three Colonies, is about the size

* The same phenomenon of a canal passage joining the waters of two big rivers may be remarked in the Paranacito, which connects the Paraná and Uruguay rivers across the Entre Rios Delta. Although the connection is made at the base and not at the head of the streams the action is the same, the canal flowing alternately towards the one or the other river, according to the flood or fall in either.

of the United Kingdom. The momentum of Georgetown, the capital, at the mouth of the Demerara river, combined with the vested interests of sugar-plantations along the seaboard, has confined settlement to the flats stretching from the coast-line to the feet of some old forest-covered sand-dunes, about 30 miles inland. On the sea side these coast flats were protected against high tides by an embankment built by early Dutch settlers, and practically all the progress achieved in British Guiana since those colonial days has been confined within these two parallel sandheaps. Though 8 km. of the Demerara Railway was the first complete section of railway (1848) built in South America (see Table E, Peru), British Guiana sixty-eight years later can only point to a total of 152 km., and thus takes its place, with the French and Dutch Guianas, among the most backward of all the South American States in enlisting the assistance of modern transport to open up its territory.

Behind the coastal dunes the land rises, and two minor ranges, or rather plateaux descending from the frontier, cross the middle of the colony from east to west. On these uplands the forest, which covers seven-eighths of British Guiana's entire surface, gives way to small patches of open savannah. It is upon the Brazil frontier, however, formed by the Acarai highlands which mark the water-parting between the coast and the Amazon streams, that the largest stretch of open country occurs. It is the considered opinion of many competent observers—an opinion irresistibly backed by all the three hundred years of European experience in South America—that the true centre of British Guiana lies on these healthy highlands rather than on the malarial coast. Proposals have been put forward for a railway linking Georgetown with the Brazilian boundary, which is then less than 500 km. distant in direct line from Manaos, capital of Amazonas, but local administrations have hitherto decided against the project and in favour of timid extensions of the coastwise lines. Had this policy of coastwise settlement been consistently followed in the past,* it might have secured to British Guiana the control of the Orinoco Delta, from which the Colony was finally debarred by recent arbitration, when the Hague Tribunal adjudged this important region, chiefly on the grounds of prior effective settlement, entirely to Venezuela. This gateway to the interior being closed, a coastwise railway is of quite secondary importance to the Colony's future. It may further be safely said that conditions attending the construction of any interior line to the Guiana highlands would be no more arduous, while the chances of successful colonization would be greater, than in the case of two-thirds of the railways built inland from the North Brazil coast. So far the Demerara-Essequibo Railway (31 km. long), due to the enterprise of Messrs. Sproston and connecting respectively the lower and upper navigation on the rivers named, is the Colony's only attempt at an interior line.

* During the Napoleonic wars England occupied the whole coast between the Orinoco and the Amazon Deltas, but at the Treaty of Paris in 1814 only the colonies of Demerara, Essequibo, and Berbice were formally taken over.

With reasonable care and proper selection of breeds, a modern cattle industry on the tropical highlands of the Guianas should be as feasible as it has already proved on the "sabanas" of Venezuela, the "campos" of Piauhy and Matto Grosso, or the open ranges of Central Africa and Rhodesia. The rivers of British Guiana show considerable washings of placer gold to attract the pioneer, while the forest lands, in addition to hardwoods, and especially "greenheart," contain the usual variety of fibrous plants and creepers, nuts, and the other tropical products which are common to all countries facing the Caribbean Sea. The potential water-power of the country must be enormous, though it varies greatly with the dry and rainy seasons. A striking instance of this is given by the Kaietuk Falls on the Potaro River, which make a sheer drop from the central plateau to the coast levels of 741 feet, or nearly five times the height of Niagara. It is a biting endorsement of the failure of European Colonial Administration in South America and of the common sense underlying the Monroe doctrine, that although it is the only British Colony on the South American mainland, despite the impetus given by early exploration, despite its position fronting the North Atlantic, with an uninterrupted mail service and with all England's prestige and wealth behind it, British Guiana should have been more backward in shouldering the pioneer obligations of progress than Paraguay or Ecuador. Happily for our own prestige, British enterprise under a foreign flag in Argentina, Brazil, Chile, and elsewhere has not proved itself so incapable of solving the difficulties, or averse to sharing in the good fortunes which have marked the progress of the South American Republics.

Note.—Since writing the above I have read with much interest the account published in this *Journal* (December 1916) of the journey undertaken by Mr. and Mrs. Clementi to the British Guiana highlands. Speaking with recent and first-hand knowledge, Mr. Clementi's remarks appear to substantially corroborate the premises here set forth. One is at a loss to account, either for the dilatoriness of the local Governments in not earlier establishing a healthy hill station on a location so close to the coast, or for their tardy conversion to the actual geographical facts set before them at different dates by reliable travellers. Apparently Mr. Menzies has already started a cattle ranch at Rupimuni, or Menzies Plateau, thus demonstrating its suitability for live-stock breeding.

This Guiana plateau country is of course not limited to the British Guiana frontier. Although the width of the open pastures is not great, apparently averaging not over 10 miles, their length, owing to the irregularities of the Amazon water-parting, is probably not far short of 1200 miles, stretching from the valley of the Upper Orinoco to within 100 miles of the Brazilian coast.

Dutch Guiana, whose general characteristics resemble those of British

Guiana, has a single line of 140 km. which runs inland and almost due south from Paramaribo, the capital, to Macami on the Surinam River.

French Guiana has no railways, but in October 1913 the General Assembly granted a concession for the construction of a line into the interior, connecting the basins of the rivers Comte, Appronaque, Mana, and Inini.

Conclusions.

We have now completed a hasty survey of the chief transport routes of South America. Let us marshal the facts.

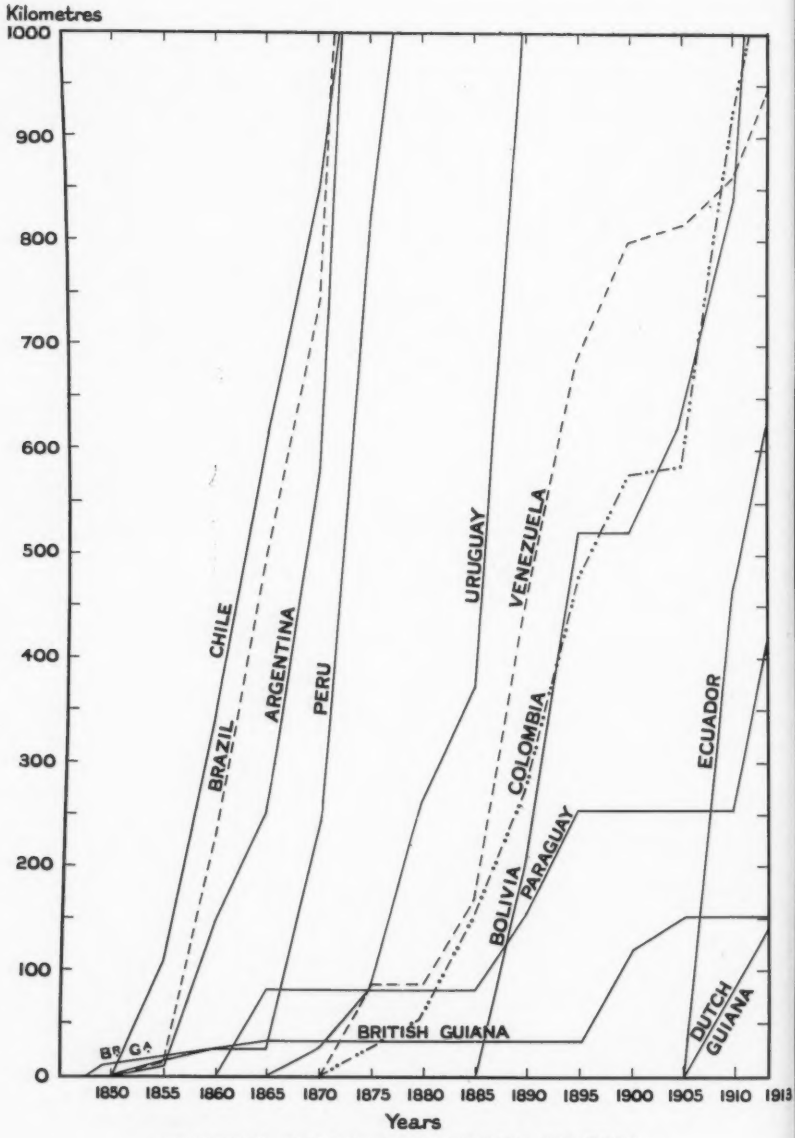
We have seen that over most of South America the difficulties of establishing an efficient transport service are perhaps greater than over any equal self-contained area. The physical obstacles alone are gigantic. State boundaries seldom coincide with purely geographical frontiers. Political control is divided among thirteen self-contained colonies and republics which, in their turn, have granted large measures of local autonomy. The result is confusion in dealing with the transport problems of the continent as a whole, while everywhere we find lacking that co-operation in technical and operating detail, necessary even to local efficiency over any wide area.

Outside the employment of beasts of burden—including man himself—the elements of interior transport in South America are only two, the river and the railroad. Motor transport, although it has been officially attempted in São Paulo State and in Venezuela, must await the construction of proper highways. Rivers on the southern pampas, on the Atlantic coast plateaux, and on the Altoplanicie of the Andes are either few or non-navigable; but in these very regions, where the railway has attained its maximum development, its expansion is due less to lack of water competition than to a healthier soil and climate, attracting immigration and ensuring steady farm production by the free aid of live stock. On the other hand, in the river-basins of the interior—almost entirely uncultivated—navigation is broken by rapids and subject to violent fluctuations of level. The interruption to traffic caused by low water, or (when going upstream) by floods, is equivalent to that caused on the railway by accidents or damage to track; while these hindrances to river transport have the added disadvantage, that they are beyond man's power to control and at times even to foresee. As competing transport facilities are tested by the settler and by Governments, the railway, especially in more temperate portions of the River Plate watershed, tends almost entirely to supersede river navigation. Thus while in the great tropic basins rivers must always provide the major outlet avenues transport in the south and near the coast has cystallized in overland routes, most of which are already occupied by railways.

It is the essence of all sound transportation, by whatever method or route, that while revealing new resources within its zone, it also and chiefly

MADEIRA-MAMORE RAILWAY, BRAZIL

TEMPORARY TRESTLE, MADEIRA-MAMORE RAILWAY



RAILWAY PROGRESS IN SOUTH AMERICA

Showing rate of construction of the first 1000 km.

aims at the elimination of waste. For lack of mechanical equipment the Spanish viceroys in ransacking the mines of Peru "wasted," it is said, eight millions of Indian lives. This same waste, not perhaps of life but certainly of human labour in providing transport, has continued in South America ever since. It is not sufficiently placed to the credit of existing railways that whether successful or not in themselves, they have as a whole certainly more than doubled the efficiency of the all-too-scant labouring population of the Continent.

The task set before the railways * of South America is best illustrated by the efforts they have already made. They scale perpendicular ramparts, searching for foothold like a wary rock-climber, before running out on the Brazilian plateaux. They pant up the flanks of the Andes, bastion heaped on bastion, till at 15,000 ft. altitude they traverse the perpetual tropical snows. They run half smothered in jungle valleys. They link up, circumvent, or surmount rivers often great, always dangerous. They drive across untilled, monotonous pampas that colonists make fertile in their wake; or wind an uphill path to dreary mine-dumps. Their engines burn impartially coal, briquette, lignite, petroleum, hardwood, cow-dung and fungus. Sometimes their road-bed is blasted for miles through solid rock; at others great boulders constantly bombard the track; yet again, especially in Buenos Aires province, stone ballast is regarded as a luxury to be afforded by millionaire railways only.

To the engineer or the student of transport problems, South American

* In dealing with the railway systems which form the chief strategic routes of the South American Republics, mention has purposely been omitted of their tramways. These serve all the more important cities and, when electric power is employed, are the engineers' last word in transport service. The omission may seem the more obvious, since many of the electric lines reckon a kilometrage far exceeding that of the smaller up-country railroads. The electric tramways of Brazil, for instance, with 1200 km., exceed the respective railroad systems of the Guianas, Venezuela, Colombia, Ecuador, and Paraguay, while the single Anglo-Argentine tramway undertaking in Buenos Aires, with 605 km. of surface lines and 14 km. of subway, is valued at a figure which would suffice to rebuild the mountain sections of every Transandine railway on the Pacific coast.

In tramway mileage Rio falls far below the total of Buenos Aires, but it is worth noting that construction of electric tram-lines in or near the Brazilian coast cities, assisted by prodigal water-power, is outstripping similar work in Argentina, where the cost of fuel is a serious item. São Paulo city comes fourth with 226 km., being beaten by Montevideo with 268 km.; but in general it may be said that there is no single country in South America which does not boast its city electric lines, while horse-trams are common in every provincial centre.

There is however one great distinction between the electric tramway and the country railway proper. The former is primarily designed for city passengers; the latter in addition to passengers carries also up-country goods and produce. Tramways are a convenience; if their operation is suspended their unhappy passengers can walk. Colonists and industries settled along the lines of a railway, on the other hand, can depend on the Government to ensure its maintenance for their benefit. I have not wished to extend a survey which is concerned chiefly with these interior routes. Still less do I wish to minimize the important part played by systems dealing with the complicated conditions of city and terminal transport.

railways make the same appeal as the clientele of a great metropolitan hospital does to a doctor. Here may be seen transport undertakings in every stage of development—complete, arrested, or embryonic. Too often a line inherits a weak constitution from its sponsors, but the most common, and almost incurable, defect is bad location due to faulty or inadequate surveys. Nevertheless few railways in South America are daunted by the knowledge, if they ever pause to diagnose it, of their physical or administrative defects. Indeed the adventures of many roads read like the romantic expeditions of the early colonial days; how some prospered and became great and famous, while others failed and perished miserably. The Patillos Railway in the nitrate district, for instance, achieved 80 km. of construction under a running fire of litigation, until it stopped, choked by red tape, 19 km. from its goal. One or two engines and trucks are still standing on the old iron rails, half buried in the desert sands of Northern Chile. The Tolima Railway had its Transandine dreams rudely broken when the Colombian Government, during a political upheaval, hastily commandeered all the rails from its 15 km. of track in order to improvise ironclads on the Magdalena River. The railway drooped but did not quite die, and has lately revived under a liberal vote from Congress. The Sta. Barbara Railway of Venezuela, built in a tropical valley, was abandoned by its original owners after repeated wash-outs from an irrepressible river. It was then leased to a private gentleman who reported lately that, as the river continues to be unmanageable he is maintaining the railway service at these points "por impulso de hombre," *i.e.* by hand-trolley—a very sporting affair. Finally, there was the railway which started up country from a point on the Brazilian coast between the Amazon Delta and French Guiana, without the formality of advising any of the Governments interested. Its general policy and aims were so extremely obscure that, on emerging from their Arcadian solitudes the promotors of the undertaking fell under the ban of high diplomatic circles and the orphaned line * is no longer marked on new maps. On the other hand, turning from the perusal of these romantic records to railway blue-books and Government statistics, we find great State and private systems, the seats of the mighty, whose administrators commune with the European and North American railways as with peers and equals.

In a continent so happily remote from the danger of foreign military aggression the growth of the main inland routes must always chiefly depend on successful settlement. Owing to the colonists' sound preference for the healthier areas, an instinct reinforced by his need for economizing labour, we have seen that settlement has been most successful in the more open

* Mello's Atlas of Brazil (1909 Edition: Pará State) shows a line starting at the Calcoene River and running for 110 km. between "Daniel" and "Lorena," through a country ostentatiously marked "Gold." The railway is not recorded in any of the statistical returns issued by the Ministry of Ways and Communications of Brazil, or elsewhere.

spaces, that is upon the pampas, savannahs, and in upland Andean valleys.

Large areas of such pastures and open park-lands still await effective * occupation by the colonist in South America. They are, in rough order of precedence, that is to say, of desirability: (1) The Argentine foothill country of Patagonia. (2) More or less open cattle country, interspersed by quebracho and mixed forest, in the Argentine, Paraguayan, and Bolivian Chaco, and along the western bank of the Paraguay River as far as the Chiquitos Hills. (3) The cattle country in Matto Grosso, Goyaz, and other States covered by the mid-Brazil highlands. (4) Cattle country in the Orinoco basin and on the Guiana highlands. (5) Sheep pastures on the Andes, ranging from the limit of tree and shrub growth up to the snowline, *i.e.* from 10,000 to 16,000 feet. (6) The hinterlands of Bolivia and the Peruvian "Montana," containing limited areas of pasture set among Amazon jungles. The main routes leading to and from these districts are still unfixed, and will so remain until the pressure of settlement makes its voice heard. Elsewhere in South America the afforested regions present greater obstacles to the settler, not only through lack of labour to subjugate them, but from the difficulty or impossibility of making a free use of live-stock to supplement his efforts. While many interior routes still await definition, however, the majority of the coast outlets towards which they will ultimately trend are already fixed, and will benefit in proportion as fresh settlement extends inland.

It has been the constant pre-occupation of South American Governments, while inviting foreign co-operation, to safeguard the State's right and its freehold in all transport enterprises. Failure at times to hold the balance between State rights and private vested interests has occasioned most of the troubles of foreign-owned transport undertakings in South America. The necessity for properly codifying railway laws is already apparent. Many of the existing laws in force are superficial or obsolete, and permanent Railway Commissions in each State, on the analogy of those acting as impartial umpires in Canada and the United States, will doubtless soon be the rule. More South American Railway Congresses, like that at Buenos Aires in 1910, might do much to promote fruitful co-operation. If they attain no immediately practical result, they at least educate the intelligent travelling and business public, who are mainly concerned, as well as stimulate the backward statistical and survey departments of their respective Governments.

Recent advance, both in the mechanics of locomotion and the technique of survey, has been already much hastened by the lessons of the war. It will be difficult, if not impossible, that such major errors of

* Most of the land referred to, especially in Patagonia, the Chaco, and the Orinoco Valley, has already passed from fiscal to private ownership. Even so it is but scantily grazed. By "effective occupation" is implied roughly the results which would be expected from fenced-in, as opposed to "open range" lands.

railway location as mark, for instance, the Central Railway of Peru and the Transandine line between Buenos Aires and Valparaiso, should be repeated. The wireless telegraph and the use of aircraft and aerial photography will make preliminary reconnaissance in mountainous or forested regions a matter of days instead of months. New methods will certainly be more boldly tried in new places. The extended use of the train-ferry, the rope-railway, of oil burning and internal combustion engines is already assured. The production and use of hydro-electric power, although comparatively recent, is capable of greater expansion in South America than in any other continent. On the other hand, it is a notable weakness that iron ore and coal have not so far been found close to a good labour market, save to a limited extent in Southern Chili, and in consequence the valuable asset of a domestic steel-supply has been withheld.

When the European war ends, the need for a national stocktaking in South America will certainly ensure an energetic "push" in the matter of transport generally and of railroads especially, besides which past developments, however important they seem to us now, will be dwarfed. But while searching out and incorporating new routes and methods of transport, either by land or water, let it be a constant preoccupation both of the State and of the railroads themselves to maintain an ever-higher level of efficiency on the existing lines. Only the railways which run smoothest know how much still remains to be done. Therefore, even while applauding their past heroic efforts, let us counsel a divine discontent. Let us trust, in conclusion, that when the new era of peace arises British Guiana and the other European colonies will take their proper position, as friendly rivals in progress with the native-born South American States.

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Before the paper the PRESIDENT said: At the outbreak of war it was suggested to me that the Royal Geographical Society would have to put up its shutters, or at any rate to give up its Meetings. Fortunately the Council took a different view, and at this moment we are involved in an outbreak of activity I believe quite unprecedented in the Society's annals. Without taking into account Mr. Weston's charming Lectures to Young People, we shall have had in eight days three Meetings of the Society. It may strike some of you as curious that all these three Meetings should be devoted to one Continent—South America. The result is accidental, but I cannot look upon it as inopportune, for whatever may happen in Europe I think there is no doubt that South America is destined to play in coming years a large part in the world's history. It therefore cannot be amiss that we should learn as much as we can of the prospects and conditions afforded by the physical facts of that great continent.

I have said "whatever may happen in Europe." We here can foresee, and believe we are justified in foreseeing, but one result to the great war: the triumph of the Allies. But imagine for a moment the contrary. Imagine the victory of Germany, and the Kaiser enabled to fulfil the ambition which he revealed by calling himself "the admiral of the Atlantic." The Monroe doctrine has at the present moment for its only real safeguard the British fleet. Can we believe that if that fleet were removed any part of the American Continent would be safe from German attack? On the other hand, look to what we trust is certain: a Germany defeated, and deprived of many of her colonies. The Prussian despotism destroyed, there will remain the great German nation, a nation reformed, we hope, as to its worst characteristics, but retaining its better qualities. Such an efficient nationality must in time seek fresh outlets. And where is it more likely to find them than in the districts of South America already occupied by large German communities, which I understand are very prosperous. Do not let me be taken as inviting a political discussion. Our business here is to formulate the facts upon which politics are, or ought to be, based. It is in this sense that any divorce between geography and politics must be dangerous, and, as it has proved in past history, may be disastrous.

With these few words as a prelude I introduce in Mr. Barclay one of the Englishmen who has visited and traversed South America in many directions and knows it thoroughly. He will tell us what are its characteristics and its capacities of future development.

(*Mr. Barclay then read the paper printed above, and a discussion followed.*)

Señor AGUSTIN EDWARDS (Chilean Minister): Before I say a few words upon the interesting lecture we have just heard I wish to thank the lecturer

for the very able description he has given us of the resources and possibilities of South America. I am sure that I am interpreting the feelings of my country, which, in this case, are perhaps shared by the sister Republics of South America, when I say that lectures such as these help more towards a better understanding between the American Continent and this country than the work of a hundred diplomats. The lecturer has described all the railways that have been built and are actually working in South America, and has paid a tribute to the Governments of those countries which have encouraged the construction of these railways. But there is one thing he has not said and that I wish to say: it is that the greater part of the railways you have seen in the pictures he has shown have been built by British enterprise and mostly with British capital. I have often wondered whether this initiative was due merely to the seeking of remunerative investment of capital; and I have found that it does, to a certain extent, explain the enormous development of British railway construction in South America. But there is another factor which ought not to be forgotten. I think there is a feeling amongst Englishmen—a sub-conscious feeling, perhaps—that to the gigantic organization known by the world as the British Empire the welfare and prosperity of the American continent is of as great interest as the welfare and prosperity of the continent of Europe. We perhaps do not realize to-day, probably because of this terrible European war, the tremendous changes that the Panamá Canal is bringing to the American continent and to the world at large. The lecturer pointed out that most of the coast railways that have been built in the South American Continent are on the Pacific side, in spite of the fact that the western coast of South America was in, so to speak, a *cul de sac*, cut off from the great markets and centres of the world. With the Panamá Canal open, the building of railways on the part of the South American Continent is bound to develop enormously. In my country, I believe, there is a large field for British enterprise and British capital in the building of railways after the war is over (for I think it will be found, when peace is restored, that British energy is as alive and British capital as abundant as ever). With the opening of the Panamá Canal it is only natural that all the products of Western Argentina should find their way to the sea, which is always the cheapest way of transport, through Chile. As you know, Chile is a very long and narrow country, and through it Argentina, which occupies the rest of the southern part of the American Continent, is bound to try and find an outlet for its inland products of every kind. At the beginning only the raw material will pass through Chile, on its way to big markets of the United States and Europe; afterwards, in the course of a very few years, you will find, I think, that the raw material which is produced in enormous abundance in the Argentine Republic will be transformed in Chile into more valuable products, because we have in our country the three main factors which tend to make a manufacturing country. We have iron in abundance, coal in abundance, and water-power in abundance; and therefore there is for British enterprise in that part of the South American Continent a very large field. I believe that England will, in spite of all that is being said at present, continue to be the financial centre of the world, and that every advantage will be taken of this opportunity.

But that is not the only remark I wish to make. At the end of July 1914, just before the war broke out, I had the honour of spending two days under the same roof with Lord Kitchener and talking with him. I reminded him that while he was in Australia two or three years before he had been in communication with me while I was in Chile, and had been trying to get to Chile direct

from Australia. I asked him what his object was in going to Chile, and he told me that he was convinced that before very long there would be a line of steamers running from Australia and New Zealand to the Chilean coast, because, he said, very few people in this country realize that Australia and New Zealand were only ten days' navigation distance from the Chilean coast; that there was a railway—the Transandine railway to which the lecturer referred—which links up the Pacific with the Atlantic and crosses the South American continent in thirty-six hours; and that there were rapid steamers which came from Buenos Aires to England in eighteen days; and therefore about a week would be saved by adopting this route. I only repeat what Lord Kitchener said at that time; to my mind it is a very interesting remark, and something that ought to be borne in mind for better times. I wish to thank you, Mr. President, for the opportunity afforded me of addressing you, and the lecturer for the interesting lecture he has delivered.

Mr. OLIVER BURY: Mr. Barclay's paper is particularly interesting to me because not only did I spend several years in South America, but I have travelled over nearly every railway he mentioned in his paper, and I am now actually engaged in the direction of some of the mountain railways to which he has referred. It is rather late, Mr. President, to attempt to discuss the gauge question, so I propose to leave it alone. I will confine my few remarks to Peru, which both geographically and historically is one of the most interesting countries in the world. Prior to about the fourteenth century the whole history of Peru is wrapped in mystery; but on Lake Titicaca there are remains of very early civilization. The ruins of Tiahuanaco are supposed to date some 3000 years B.C.; and those who have seen the ruins of Upper Egypt cannot but be struck by the extraordinary similarity between the two. I was very much struck with the beautiful chiselling of all the masonry at Tiahuanaco, for I never saw anything to touch it, although I have been almost throughout the whole of Egypt. It is difficult to find out how the ancient Peruvians cut those exceedingly hard stones; but I think there is little doubt that the tool was composed mostly of copper with a little tin.

Any one visiting South America, especially the interior, is struck by the absence of roads; and yet before the Spaniards reached Peru there was a network of highways which according to the Spanish historians received the unanimous admiration of them all. There is or was one notable highway running all the way from Cuzco to Quito, some 1500 miles long, about 20 feet wide, paved all the way with freestone, with a sort of bituminous cement run into the joints. Along this road were stations amply provided with provisions; and the old explorer Francisco Pizarro would have died of starvation if he had not been able to help himself to those stores. The road was neglected by the Spaniards, and there is very little trace of it left to-day. Another curious feature was the postal service which the Spaniards found, and which they say existed long before there was any such post in Europe. There were runners who ran each a comparatively short distance, but very fast; and they could take a message about 150 miles a day. But since the Incas had no written language, one doubts whether the message, after passing through so many mouths, reached its destination quite in the form in which it started.

The Central Railway of Peru, of which I happen to be the Chairman, is really one of the sights of the world. It starts from sea-level and goes away for over 100 miles up a grade of 1 in 25, with a load of about 120 tons behind the engine, which is like a heavy coal engine. A few years ago they were using coal for fuel, and it was very difficult to keep steam on a continuous

grade of 1 in 25 for 100 miles, but now these difficulties have been overcome by using the rich petroleum found on the coast of Peru. I will conclude by congratulating the author on his most excellent paper.

Mr. HERBERT GIBSON: South America is such a very fruitful theme, both historically, industrially, and geographically, that I will only make one or two remarks on the extremely interesting paper we have had the pleasure of hearing. The President, in his prefatory remarks, and also the lecturer, made some references to German colonization of South America. I am not going to belabour that subject in any way, but merely to refer to one historical and to one ethnical fact. The historical fact is that some three and a half or four centuries ago the Crown of Castille granted to some German bankers the very large tract of land that lies more or less between Cumana and the Lake Maracaibo, and which now forms the Venezuelan territory. During thirty years, headed by men of considerable ability in adventure, and especially by one Federmann, who reached as far as the plateau of Bogotá in what is now the Republic of Colombia, they did not succeed in establishing one small village; and during the whole of their occupation of that territory the only town formed was founded by a few Spaniards who lived under their rule. At the end of thirty years their grant was annulled, and they ceased to exist in that part of the world. That is the story narrated by Mr. Bernard Moses, the well-known writer on South American history.

My second point is the present ethnical relation of a German colony in the south of Brazil to the population of that region. There is a town called after a hairdresser who was one of the original German colonists, and whose name I have had the discretion to forget; but the place is known better under its old Guarani name of Itajahy, and it is precisely where Nuñez Cabeza de Vaca, travelling from the Atlantic seaboard, started for Paraguay in 1540. During the last sixty years these German colonists have spread west; one meets them in South Brazil, and as far up as the Bolivian Chaco, trading with Bolivians there. It is remarkable—and I think those who have travelled in that part of the world will confirm what I say—that they seem to have lost all their German traits, and to have become entirely assimilated by the local population; to such a point even that they seem to prefer to speak the Indian language of Guarani rather than their own. So that in regard to the territorial occupation of any part of South America—which is one of the remote things I do not expect to live to see, because I conceive South America sufficiently occupied by the South American nations—it seems to me that the Germans have not the gift which other nations of Europe have, of adapting themselves to the conditions of the ordinary colonist. I would like to mention what many who live in South America are aware of—the great help railways give to a better knowledge of the climatology and meteorology of the country. It is not easy, where Budgets are somewhat limited, for Governments to establish within their administrations a sufficient range of meteorological observatories. The British South American railways have very largely filled that gap. It has been useful to them also, because had they been acquainted earlier with some of the meteorological conditions they would not always have taken the lines that their railways now take.

The lecturer referred to the success with which sheep have been introduced into the east side of the Bolivian Cordillera, and showed us a picture of the Corriedale sheep. But the Corriedale sheep is not from Scotland; it is a New Zealand sheep. The New Zealanders have come and occupied a great part of South Argentina; New Zealand machinery, Australian seeds, New Zealand

and Australian live stock, and New Zealand and Australian sheep-farmers and agriculturists have established themselves, and have been a very useful factor in the development of the pastoral and agricultural interests of the Argentine. I endorse very heartily the remarks made by the Minister for Chile on the trans-continental railways. We in the Argentine all recognize that in Chile, with the spirit, if I may so say, of the Araucanian people who inhabited that country before the arrival of the white man, the Chileans have developed, and intend to develop still further, all their manufacturing and mechanical industries. I am persuaded that Chile is to become a most important manufacturing country, and I think the linking up of the Argentine with Chile by trans-continental railways will be of mutual benefit. There is no question in South America of any other strategy than commercial, and I am persuaded that this is a very sound commercial strategy. I congratulate Mr. Barclay on the extremely interesting paper he has given us, which I have listened to with great pleasure.

The PRESIDENT: I am sure you would like to hear a few words from Sir Thomas Holdich, and his opinion of the attempts to pierce the barriers which he has been at so much pains to create.

Col. Sir THOMAS HOLDICH: If I say a word or two it will be to endorse the lesson which Mr. Barclay has tried to teach us, that the alignment of railways should depend on the geography. If we remember the way in which railways begin in new countries, we shall be surprised sometimes that they turn out as well as they do. Sometimes railways are projected for military purposes, and subsequently harden into permanent lines. Such has been the case in Egypt and the Sudan, and such may be the case in Mesopotamia. But more often the first lines are run rather irresponsibly to develop some particular region, and are not intended to become permanent lines eventually. Some of the most important lines in Australia began in that way, and I have heard the system advocated as very excellent. In India that sort of thing is not allowed. They have a sealed pattern for a railway, which is a most effectual barrier to private and local enterprise. Sometimes a high railway official may be so influenced by knowledge of one particular line that he fails to grasp alternatives. I cannot help thinking that something of that sort occurred when they set out to connect Buenos Aires with Valparaiso, for I can hardly believe that the Uspallata Pass was the best line that could have been chosen. The line from the pass down to the foot of the Andes on the Chilian side will be a constant source of anxiety and expense for all future time. One feature of South America may possibly have struck you: that there is no place for any great meridional line, such as we hope to see in Africa. Mr. Barclay has pointed out what may eventually happen in the way of a combined railway and river route, but I cannot imagine that any railway will ever cross the great Amazonian basin from north to south, and I think that will prove a drawback to the development of the country. We have been told that trans-continental lines connecting up with sea communication with New Zealand and Australia will be exceedingly advantageous. No doubt it would be so; but we must remember that there are very serious competitors in the field further north, and first of all the Panamá Canal, which I may say parenthetically is a brilliant instance of how a magnificent and most expensive undertaking was projected without proper geographical knowledge. I cannot imagine that it would have been cut where it is had there been a little further knowledge of the Atrato line. I am most anxious to hear of the completion of a Patagonian line, because I am convinced that there is a good deal more than through traffic to warrant its

construction. I hope to see all the Lake region brought into direct connection with Europe. Finally I must congratulate Mr. Barclay on the diligence and success with which he has collected the enormous amount of information on the railways of South America.

The PRESIDENT: I regret that the hour does not allow me to call upon other gentlemen here who might add to our knowledge of South America. We have had a large subject dealt with in a very able manner, and I am not going to detain you with any remarks of my own. I will, however, make one comment on that interesting remark of Lord Kitchener's which was reported to us. I am sure the idea of a through steamboat and railway route home *viâ* South America would be very popular in Australia and New Zealand. My reason for so thinking is that when I was in Japan three years ago I met several parties of Australians. I asked them why they were there: they said they were going home to England. I asked why they were going that way; they replied, "Oh, well, we have been by all the ordinary routes and we are trying to find a new one." I think if a still newer route was added it would be welcome to our Australian relations. I can only add our thanks to the Lecturer for the many facts he has put before us in such a clear way.

THE SOUTH-WEST AFRICA PROTECTORATE

T. Tönnesen, C.E.

Map following p. 320.

IN attempting to give a sketch of a country nearly three times the size of Great Britain and Ireland, I have found it necessary to avail myself of different sources of information, in addition to my personal knowledge of the Protectorate, which dates back to 1899. It is hoped that the paper, although inadequate, will contribute to some extent towards the knowledge of the country. The map is based by permission on one published by the weekly journal *South Africa*. I have added the different mineral finds and the curves of rainfall.

The Protectorate of South-West Africa is bounded on the north by Angola and Rhodesia, on the east by Bechuanaland, on the south by Cape Colony, and on the west by the Atlantic Ocean. The extreme distance from the northern to the southern boundary is roughly 800 miles. The width (excluding the Caprivi Belt) tapers from 620 miles in the north to 220 miles in the south. A wedge-shaped projection, the so-called Caprivi Belt, extends from the north-east corner of the Protectorate to within 40 miles of the Victoria Falls. The area of the Protectorate has been estimated at 322,400 square miles.

The country is a vast plateau with altitudes varying from 3000 to 5000 feet. The plateau proper is reached at a distance of about 100 miles from the coast, the ground rising at first gradually and then somewhat abruptly to the plateau. The Protectorate may be divided into the following physical regions: The Namib, Damaraland, the Karst Region, Kaokoveld, Great Namaqualand, and the Kalahari, including Amboland.

The Namib or Coastal Desert is a narrow strip of country extending from the Cunene to the Orange River, a distance of 850 miles, and varying in width from 30 to 80 miles, with an area of approximately 47,000 square miles. It is practically bare of vegetation. Generally a thin sheet of sand covers the underlying rock; an occasional hill or even mountain range breaks the monotony of the wide yellow expanse; and sometimes a mirage will present to view large sheets of water, and turn small bushes into trees. Although the general impression is that of utter desolation, to the explorer the Namib has its fascinations. Near the coast there are large tracts of sand-dunes whose height, at least in Kaokoveld, very seldom exceeds 30 feet. The coast is generally low and flat; only in places is it hilly and rough.

Excepting the Cunene and the Orange, all rivers passing through the Namib are intermittent. They carry underground water which generally, especially in Kaokoveld, comes to the surface on the coast, or is found at shallow depths there. From the Kuiseb northwards the river-beds are generally well wooded, with big acacia trees. In the Hoarusib River I found the Anabaum (*Acacia albida*) and fig trees within 25 miles of the coast. Only the large rivers like the Swakop, Omaruru, Ugab, Huab, and Hoarusib, have been able to maintain an open channel down to the sea; all the others, as far as our knowledge goes, are choked with sand in their lower course, or end in lagoons and salt-pans not far from the coast.

Although there is practically no vegetation for the first 40 miles from the coast, we find occasionally plants like the *Welwitschia mirabilis*, the Ganna, the Milk Bush (*Euphorbia sp.*), the Bushman Candle, and species of *Mesembryanthemum*. With a few good showers, which may happen once in ten years, the Namib becomes verdured and teems with game, especially springbok. The Namib merges slowly into a semi-desert or transition zone, which separates it from the high plateau.

In the western part of the transition zone of Damaraland the vegetation is very scant, but changes gradually as we proceed further inland. Thorn-bushes make their appearance, grass becomes more abundant, the bushes are more sturdy, and vegetation on the whole becomes more and more luxuriant. Grazing in this area is uncertain on account of droughts. The region is best adapted to small stock and horses.

The south-western part of Damaraland is mountainous. A few miles to the south of Windhoek are the Auas Mountains, with heights up to 8100 feet, while the Khomas Highlands to the west of this range have an average elevation of 6000 feet with eminences reaching to 7000 feet. Between Windhoek and Okahandja are the Onjati chain of mountains with similar altitudes, and in the Erongo Mountains to the north-west of Karibib heights of 7500 feet have been recorded. The mountain slopes are practically barren and the vegetation is confined to ravines and defiles. The average rainfall in these parts is from 10 to 18 inches, and very good grazing is found in the valleys and depressions; cattle, horses, and small stock do exceedingly well here. In the Swakop River, which takes its rise

in these mountains, as also in its tributaries, underground water is always to be found, sometimes at comparatively slight depths. Outside the river-beds water has also been made available by borings, and by impounding the run-off of rivulets by dams and reservoirs.

Further to the north and east are the great plains of Damaraland, studded with isolated mountains and a few mountain ranges, as the Okavaka, Etjo, Waterberg, and Paresis, with altitudes ranging from 6000 to 7000 feet. To the east of Omaruru the two grand cones of Omataku with an estimated altitude of 8800 feet tower conspicuously above the surrounding country. The average altitude of the plains here is about 4600 feet. The primary soil of the Namib has been succeeded by secondary soils, containing all the elements for the growth of grass. With this, and a favourable rainfall, the whole aspect of the vegetation has changed. The thorn bushes have become trees; new species of the Acacias and other foliage trees appear; and there is abundance of grass. The landscape is in places open, reminding one of the Dakota prairies; but the major part is fairly well wooded, affording good shelter for the cattle from the burning rays of the sun. Excepting perhaps in Amboland, there is nothing in the whole of the Protectorate to which the name forest can be applied. The only approach to it is found in the park landscapes of the Omurambas (intermittent rivers). While in the south of Great Namaqualand the fodder is principally herbage plants, it is here limited to grasses only, which form a wholesome food for the cattle. Standing on their stalks from one rainy season to the following, the grasses lose but very little of their nutritive properties, and, judging from experience in the transitional zone where droughts are not uncommon, can thus tide the cattle over two seasons.

In the north the plains merge into the Karst region, and in the east to the Sandveld. Damaraland slopes to the Etosha pan, the Atlantic Ocean, and the Kalahari; and the most important waterways (all intermittent) are the Swakop, the Nosob, the Epukiro, the Omuramba Omatako, and the Omaruru. The annual rainfall ranges from 8 inches in the south-west to 20 in the northern and eastern parts.

In former days the main Herero verfts (villages) with their large herds of cattle (which previous to the rinderpest in 1897 were estimated at 125,000 head) were always located near the rivers or Omurambas, where water was easily accessible at no great depth; elsewhere the average depth of wells is about 150 feet. The Herero has gone; his verft, which on the beaten track served as outspan and watering-place for the traveller and his animals, has been superseded by the modern farmhouse. Damaraland, the former home of the Hereros, famous cattle-breeders, has a great future as a stock-raising country. In the extreme north and east cereals such as maize and Kaffir corn, and also tobacco, can be grown with fair success; and with help of irrigation the farmer can always raise sufficient cereals to cover his own requirements.

NEINEIS, OMARURU RIVER IN FLOOD

LAKE OTJIKOTO, KARST REGION

OTAVI VALLEY

GUCHAB STATION, OTAVI-GROOTFONTEIN RAILWAY

The Karst region is bounded by Grootfontein, Outjo, part of Kaokoveld and the Etosha Pan. The mountainous part is included in the country between Otavi, Guchab and Tsumeb. A small range runs from about Otavi to Naidaus; otherwise it is a big flat sloping gently towards the Etosha pan, with a few scattered hills, an occasional farmhouse and windmill, pepper trees, eucalyptus grove, and orchard. The Otavi dolomite series are predominant here, and altitudes up to 7200 feet have been recorded in the Otavi range of mountains. The country is characterized by its sink holes, caverns, and springs, and by the absence of defined waterways. The lakes of Otjikoto and Guinas are the most prominent of the sink holes; they are of about the same size, elliptical in form, and measure about 600 by 800 feet across. The Otjikoto Lake is supposed to have a depth of 600 feet and to be of comparatively recent origin. An old Bushman related to me that when his father was a child the Bushmen used to encamp on the site of the lake. The distance between the two lakes is about 15 miles, and barometric measurements indicate that the elevation of the water-level is the same for both. Foremost among the caverns are one to the north of Nosib and another south-east of Gaub.

A number of "fountains" or springs issue from the dolomite, the most important being those of Otavi and Rietfontein; and subsoil water in great abundance is found everywhere at depths varying from a few feet to 150. The average annual rainfall is about 20 inches. The region is on the whole well wooded, and eminently fit for cattle raising. The rainfall is highest in the north-east. The annual rainfall in Grootfontein over fourteen years was 24 inches; in Otavi and Gaub it is the same; while in Tsumeb and in the mountains it is more, about 28 inches. This area is well adapted for cereals, the staple crops being maize and Kaffir corn; while potatoes, tobacco, pumpkins, etc., are also grown successfully. Wheat, oats, barley, and lucerne are grown under irrigation, and recent experiments seem to show that wheat and lucerne may in favourable places be grown without this help. Grapes, citrus fruit, peaches, apricots, apples, plums, etc., do well here, and it is expected that the Washington Navel Orange will in time become an important article of export. There is good and abundant grazing, and as maize does well and fodder will increase with the development of the country, there is the necessary foundation for a large live-stock industry. It is certainly the place for the man of limited means.

Kaokoveld is in the north-west corner of the Protectorate. The western part, to within 30 miles of the coast, is generally rough, rocky, and mountainous. It is cut up by many rivers and their tributaries; and the major part is a chaos of rugged hills, waterways in narrow precipitous gorges, and small open plains. In the rainy season the rivers rise suddenly, and where half an hour before there was a dry sandy channel there is a raging torrent with depths of water up to 10 feet or more. The approach of the water can generally be heard from some distance, through the rolling of the stones and the smashing and creaking of trees and logs. A chain of

table mountains runs along the whole length of the coast, at a distance of about 40 miles from it, reaching elevations of nearly 4000 feet; they are capped with enormous sheets of amygdaloidal melaphyres and augite porphyrites. In exploring the coast I have on several occasions tried to find a place sheltered behind some rocky hill against the prevalent strong south-west wind, where I could camp over-night, but invariably found the beach preferable, as behind the hill the wind came from all quarters, even from above. All obstructions are exposed to a regular sand-blast, and the rocky hills are being slowly worn away and drowned in their own detritus.

The eastern part of Kaokoveld is formed by the plateau which slopes towards Amboland, the Etosha Pan, and the Atlantic. The Otavi Dolomite Series runs along most of the eastern border, and a fairly large number of springs are found there. On the whole Kaokoveld is well watered, and there will be no difficulty in obtaining water over the whole of the region that is worth consideration for settlements. There is good grazing at Urunendis, to the south of Zessfontein and 40 miles from the coast, as also at Nadas, similarly situated to the north. The transition zone extends closer to the sea than in Damaraland. The eastern part is well adapted to cattle-raising, and in the transition zone wool sheep or small stock should do well. Fertile soil is generally found in the valleys, where irrigation on a small scale may be carried on. It is a country for stock-raising on a large scale, and hardly the place for men of medium or small means. As for game, there is an abundance of it, and I shall deal with this later.

Great Namaqualand, or "the South," is the tract of land between Damaraland and the Orange River. In the western part, and bordering upon the Namib, there are several mountain ranges, such as the Urihuib, the Tsaris, the Tiras, and also the Huib, a lofty plateau. Large grazing areas are found in these mountains. The inner Namaqualand, a plateau, has a very gentle slope from north to south, and the drainage of the region is in general carried by the Fish River and its tributaries, which form valleys in some cases 20 miles wide. These valleys are well watered, and as a rule have large stretches of luxuriant vegetation. West of the Fish River are the Nananib and Hanam (Schwarzrand) Plateaus; to the east the Kalk (Weissrand) Plateau. South of Gibeon and in the Fish River valley rises the Bruckaros Mountain, and further south, beyond Keetmanshoop, the Great and Little Karas Mountains.

Great Namaqualand is semi-arid, and droughts are frequent in the southern and to some extent in the central part. From the Orange River to near Gibeon and Karroo herbage or shrub-landscape prevails, and it is only in seasons of heavy rainfall that the region becomes verdant. It is a most desolate landscape. From the railway one sees isolated mountains, the ganger's house with a few native huts, the railway station with its accessories, and a big treeless plain. From there northwards the Karroo

slowly merges into a park or silvan landscape. Great Namaqualand is not adapted for agriculture, but is well suited to stock-raising, which in the southern and central part is practically limited to small stock, such as wool sheep, Angoras, etc., while in the northern part horse-breeding and cattle-raising are prominent. Borings for water have been successful, and in several places artesian water was struck. Most of the settlements are along the Fish River and its tributaries, where water is easily obtainable from wells or pools in the river-bed.

For the proper development of the south, and in order to minimize the effects of droughts, the Government had under consideration large irrigation schemes in the Fish River valley, the intention being to impound the run-off by a succession of reservoirs.

The Kalahari region includes the eastern part of the Protectorate. It is mainly covered with a thick layer of sandy loam interspersed with areas of calcareous rocks. In the southern part of the region the surface takes the form of dunes running east and west, and between the dunes the ground is hard. The dunes reach a height of 50 feet, and are covered with a fair amount of grass, while the hollows contain low bushes. From Gochas northward the dunes become more wooded, the low ground between is sandy loam, and the landscape is that of a lightly undulating tree and grass steppe. Good fodder grasses are found in the Kalahari, and judging from the amount of rainfall and the drainage of the country the question of water seems easily solved, so it may be expected confidently that in time to come the Kalahari will figure prominently as a cattle-rearing region. I have had occasion to consult several parties who have come through the Kalahari, and their opinions were invariably that it was a good grazing country.

Amboland, in the extreme north, is the most densely populated part of the Protectorate. The country is slightly undulating and cut up by a number of waterways (Omurambas). When in flood the Cunene River overflows its banks, and part of its water flows through Amboland and drains into the Etosha Pan. Owing to the gentle slope of the country (about 3 to 4 feet to the mile) the water flows off slowly and large tracts become inundated in the rainy season, making travelling by waggon impossible. Between the Etosha Pan and Ondangua there are large tracts of open plains covered with sandy soil. The vegetation in Amboland is more tropical and profuse than further south. As I have never been in Amboland proper, I must be permitted to give the experience of others.

Sir Francis Galton gives the following description of Ondangua: "We emerged out of the thick thorns, and the charming country of Ovampo lay yellow and broad as a sea before us. Fine dense timber-trees and innumerable palms of all sizes were scattered over it; part was bare for pasturage, part was thickly covered with high corn-stubble; palisadings, each of which enclosed a homestead, were scattered anywhere over the country. The general appearance was that of most abundant fertility."

According to Dr. Schinz the surface soil all over Amboland consists as a rule of a layer of loose sand, varying in thickness from 8 to 20 inches, below which comes a 6- to 8-feet layer of black humus soil; and he attributes the large crops of Kaffir corn and maize, obtained by the Ovambos with practically no cultivation, to the fertility of that soil. Dr. Gerber, a former Government expert, reported that the region is eminently adapted to the culture of cotton, tobacco, figs, and dates.

The annual rainfall may vary from 20 to 26 or more inches. Kaffir corn and maize are the staple crops, and constitute the main article of food for the Ovambos. One hears of occasional years of famine, but I think they are principally due to lack of modern farming implements and proper cultivation of the fields. The Ovambos hold a considerable amount of cattle, but they are small in stature owing to close breeding. Attention should be paid to the feasibility of the irrigation of Amboland from the Cunene River.

The country is not without natural beauty and charm. The sunsets have a brilliancy of colour undreamed of in Europe, when the mountains take on a range of tints blue to violet, and the African night follows with its exceptional starry splendour and calm. The spacious plains have also their grand impression of unimpeded freedom. This and the absolute solitude account for the fascination of life in the bush.

Owing to the altitude, which ranges from 3500 to 5300 feet (or more) in those parts of the Protectorate which are suited for settlements, the climate is eminently sub-tropical, though the latitudes are tropical. The mean annual temperature is about 66° F., comparable with that of Central and Southern Italy. The temperature in the shade in summer is about 100° F. maximum and 60° F. minimum; in winter 82° F. maximum and 16° minimum. Windhoek, the capital, has an altitude of 5400 feet, and the climate resembles that of the High Veld in the Transvaal.

There are two distinct seasons, one dry and cold (May–October) with a cloudless sky, the other rainy. The rains generally set in in the month of December and last till the latter part of April. The Table, p. 299, shows the rainfall for a number of years. From the map attached it will be seen that the rainfall increases from west to east and south to north. On the coast rain is the exception.

In winter an occasional light frost is experienced on the plateau, while in summer, or after the rainy season has set in, the heat very seldom becomes oppressive and the nights are always cool. Owing to the Benguela current the mean temperature on the coast is low; dense fogs, which may extend for about 40 miles inland, are frequent. The meagre rain-supply further inland is also due to this current. The present population affords evidence that the European, even under conditions of severe bodily labour, can live and thrive there. Pure air, much sun, bracing winds, which generally set in about four in the afternoon, and cool nights, all tend to make a pleasant and healthy climate. For sufferers

from lung and chest weakness the country may be looked upon as a health resort. Malaria occurs in the north, but only after very heavy rains, and to a certain extent in the centre and south. Cases of blackwater fever are very rare. During an actual stay of nearly thirteen years I was much exposed in exploring the country; my personal record is three attacks of malaria in 1909 after an exceptionally heavy rainy season. In Ovamboland malaria is undoubtedly prevalent, but hardly to the extent German officials, for reasons of policy, have tried to represent.

As settlement progressed the big game—elephants, giraffes, rhinoceros, buffalo and lions—fell back to the more remote districts. In Kaokoveld, Okavango, and Kalahari they still exist in large numbers; while the species of antelope—kudu, gemsbok, eland, hartebeest and springbok, with a few stray zebras, are still to be found all over the country. There are also leopards, hyenas, different species of wild cat, jackals, hares, and monkeys. It is not unusual to see a flock of wild ostriches racing the train. Guinea fowl are a welcome addition to the traveller's larder.

At the outbreak of war the following railways (excepting the Amboland line) were open to public traffic:—

	Gauge: 2 *feet* (0·6 *m.*).	3 *ft.* 6 *in.*
The Northern or State Railway (Swakopmund-Windhoek)	121 miles	117 miles
The Otavi Railway, with branches (Swakopmund–Tsumeb, Grootfontein and Karabib branches)	417	—
The Southern Railway (Lüderitz Bay–Keetmanshoop and Seeheim–Kalkfontein)	—	339
The North to South Railway (Windhoek-Keetmanshoop)	—	315
Amboland Railway (Otjiwarongo towards Ovamboland)...	22	—
Total State railways	560	771

Lines belonging to private companies had a total length of 90 miles, all 2-feet gauge.

During the war the Union Government extended the Prieska line *viâ* Upington to Kalkfontein; built a line from Walvis Bay to Swakopmund; changed the first 100 miles of the Otavi Railway into Cape gauge; and connected this point up with Karibib, a total of say 219 miles. Accordingly the Protectorate at the present time has 990 miles of 3 feet 6 inches gauge and 550 miles of 2-feet gauge railways, including the Walvis Bay line.

The cost of the State railways per mile (3 feet 6 inch gauge), ready for operation, averages £6000. Steel sleepers were used and the weight of rails is 40 lbs. to the yard. For the Otavi Railway (2-feet gauge, steel sleepers and 30 lbs. rails) the purchase price was at the rate of £2860 per mile.

It was not till 1897 that the Germans decided to connect the interior with the coast by the railway Swakopmund to Windhoek; the incentive was the rinderpest. With its 1 in 20 grades and 18-lb. rails the name Decauville

road would be more appropriate than railway. It was a toy affair. When the Otavi Railway was completed to Karibib the traffic was diverted to that line, and this stretch was practically abandoned. The continuation was changed into Cape gauge in 1911.

In the latter part of 1903 the South-West Africa Company, Ltd. of London, through its daughter company the Otavi Mines & Railway Company, started construction on the Otavi Railway, which was completed in 1906, the object being the opening up of the Tsumeb and Otavi Valley Copper Mines and the general development of its large mining and land concessions. In 1907 the S. W. Africa company built a branch to Grootfontein. Two years later the Government purchased the whole system and leased it to the Otavi Company for thirty years. The Otavi Railway, the longest 2-feet line in the world, has been a financial success since the start.

The next incentive to railway construction on the part of the Government was the big insurrection in 1904–06, which cost the German Empire 23 millions sterling; but it was not till two years after the commencement that they started the construction of the Southern Railway, and from that time on till 1912 they built on an average 150 miles yearly.

The lines taken over by the Union represent a value of roughly six millions sterling. The Otavi Railway was leased by the German Government then on terms returning an average of 6 per cent. on the capital invested. The other Government lines will have a yearly surplus over working expenses of about £40,000. The Southern Railway, and to some extent the North to South Railway, were built for strategical purposes.

In the estimates for 1914 provision had been made for the Amboland Railway, a line branching off from the Otavi Railway at Otjiwarongo. The immediate object was to secure more Ovambo labourers by facilitating travel to and from Ovamboland. Political considerations may also have influenced the scheme. The German Government had also under consideration a line from Otjiwarongo *viâ* Waterberg to Okahandja; one from Windhoek to Gobabis; and also a line from Swakopmund to the small settlements in the Swakop River valley.

As Rhodesia, the Bechuanaland Protectorate, and part of the Union must have access to the Atlantic coast, the following lines of railway will come up for consideration:—

First, the so-called "Cecil Rhodes" scheme of a line from Port Alexander *viâ* the first cataract of the Cunene River, Waterberg, and Gobabis, to about Lobatsi Station or Mafeking. The length of the line would be approximately 1300 miles; it would open up the Bechuanaland Protectorate (Kalahari); give better facilities to the northern and eastern part of the Protectorate; and promote the development of Kaokoveld and Amboland. It would shorten the distance from Johannesburg to Europe by at least four days. Secondly, a direct line from the above-mentioned cataract to the Katanga district, with a branch line to Victoria Falls, would in my opinion stand a better chance of success than

the Lobito Bay project, as it would command a large part of the Rhodesian traffic. The distance from Port Alexander to Victoria Falls would be about 1160 miles. Lobito Bay and Port Alexander are both good harbours, but the latter has a temperate climate while the former is tropical. Thirdly, a line from Fourteen Streams or Kimberley *viâ* Kuruman to Keetmanshoop, which would be preferable to the present line Prieska–Seeheim.

The Protectorate had two harbours, Lüderitz Bay and Swakopmund; Walvis Bay now makes the third. Swakopmund, the port for the middle and northern part of the colony, and the terminus of the Otavi Railway, is a desolate-looking place, built on a sandy flat at the mouth of the Swakop River, and but for a few private gardens there is not a speck of green to be seen. The only thing that enlivens the look of this desert place is the ocean, with its rollers breaking on the shore. The buildings are nearly all of stone or brick, with one, two and even three storeys. The investments in building here, as throughout the colony, are proportionately much higher than in other similarly situated countries. The streets are broad and straight, and generally finished with a narrow wooden or concrete side walk, but the roadway is inches deep in sand. But for the fogs the climate is pleasant and cool. It is not like other seaside places, as the sea is too cold for bathing. Life here was of a European type, with its corresponding comforts, but the place had not the charm and character of a true African city.

Swakopmund being an open roadstead, steamers used to anchor about two miles from the shore. A boat harbour was completed in 1903, but two years afterwards it was entirely silted up owing to the Benguela current and the surf; meanwhile a 1200-foot long wooden jetty was built, which is still in existence. In 1911 work was started on an iron jetty, which was to have a length of 2035 feet; about 850 feet are completed. The population amounted to about 1400 whites and 2500 natives. The town is doomed to vanish slowly, and its place as a port will be taken by Walvis Bay.

Walvis Bay, a British possession since 1878, is some 20 miles to the south of Swakopmund; its territory covered about 430 square miles. It is a grand bay facing the north with a sheltered anchorage. At present large vessels have to anchor about 2½ miles from the shore; passengers and goods are conveyed in lighters to a wooden jetty (660 feet long). Better landing facilities will have to be provided; this can be done at a comparatively low cost as the material in the bay can be handled with a suction dredger. The settlement did not look very inviting; a cluster of about twenty wooden shanties, the most imposing being the magistrate's official residence, patched up with corrugated iron, and with masses of sand sticking to the sides; a dyke of sandbags to prevent the flooding of the settlement during spring tides; beyond a fairly broad flat; and in the background the yellow-ochre sand-dunes. At times the shores of the bay

are alive with flamingoes and pelicans. Drinking-water has to be condensed or brought from Capetown. At Rooibank, on the Kuiseb River, about 23 miles south-east of the settlement, there is an abundance of good water which could easily be piped to the Bay. There was a magistrate for the district with a total staff of eight. The population of the settlement was twenty-five whites and seventy natives, while the total native population of the district was about seven hundred Toppnaer Hottentots and a few Hill Damaras. In the Kuiseb River from Rooibank inland there is a large supply of firewood and timber.

Up till 1892 the whole trade with the interior of Damaraland went through Walvis Bay, but after the creation of Swakopmund it gradually declined to traffic with a few hundred poor Hottentots. Once every three weeks a steamer called at the port, and occasionally the Navy would put in for shooting practice. About the middle of last century Walvis Bay was a whaling station of some importance, American whalers being predominant. Lüderitz Bay, or Angra Pequeña, the terminus of the Southern Railway, is the port serving the south. It is one of the best sheltered harbours in South Africa, with good holding ground in the anchorage. The landing facilities, which are adequate for the present, can easily be improved for a growing traffic to allow large vessels to moor alongside a quay. Drinking-water has to be condensed or brought by train. The population is about equal to that of Swakopmund. The business portion of the place is flat, while the residences are terraced on the slopes of the surrounding barren rocky hills. The buildings are all of stone, with quite a number of fine houses. Notwithstanding the absence of vegetation the town as seen from the Bay looks rather picturesque. It has benefited greatly by the diamond discoveries, and most likely will become an important factor in the development of the South and British Bechuanaland. It may be interesting to note that it was the construction of the Southern Railway which led to the discovery of diamonds by a Cape boy, and enabled the German Colonial Secretary, Dr. Dernburg, to nationalize the Otavi Railway and embark on a far-sighted scheme of railway construction.

In the interior there are quite a number of small towns or villages, as Keetmanshoop and Gibeon in the south, Windhoek, Gobabis, Okahandja, Karibib, and Usakos in the centre, and Omaruru, Otjiwarongo, Outjo, Grootfontein, and Tsumeb in the north. Excepting at Windhoek, their white population varies from 150 to 700. The houses, generally surrounded by gardens and patches of green, are solidly built, comprising hotels, stores, the officials' quarters, and offices. They are located on the plains and in the river valleys. Foremost amongst the towns is the capital, Windhoek, beautifully situated in a valley and surrounded by lofty mountains and high plateaus. The population amounted to about 2000 whites and 4000 natives. Windhoek has an altitude of 5400 feet; it does not suggest a rough highland place, but looks pretty and cheerful with its green trees and gardens on the slope of the hillside. Windhoek is a long and

TSUMEB COPPER MINE

ADMINISTRATION OFFICES, GROOTFONTEIN

ANABIB SPRING BETWEEN NADAS AND SANITATAS, KAOKOVELD

GARDEN OF RIETFONTEIN. FARM

narrow town, with a main street, popularly called Store Street, running north and south for very nearly 2 miles, and dividing the official from the commercial quarters. The best part of the town was carefully reserved for the residence of the officials. Out of town, more or less hidden from public gaze and very secluded, stands the Government House, a two-storeyed building invariably and significantly called the "ink-palace." The house is rather unimposing, but its position on the top of a hill is dominating, and there is a nice garden attached to it. There are a small park and other ornamental grounds in the town itself, while orchards and vineyards in the neighbourhood at Klein Windhoek make the town pleasing to the eye. Life in Windhoek was quite smart, owing to the large number of higher officials and officers living there, and at times of exhibitions and meetings it was even gay. On the whole it leaves a sunny, green, and pleasant impression.

Owing to insurrections, insufficient railway facilities, and other causes, actual mining was not begun in the Protectorate till the year 1906, when the Otavi Mines and Railway Company started at Tsumeb and in the Otavi Valley. In June 1907 the first shipment of copper ore was made by that company, and their shipments up to 31 March 1914 amounted to 233,820 tons (metric) of ore (averaging 16 per cent. copper, 25 per cent. lead, and 290 grams silver to the ton); 12,135 tons of copper matte; and about 9785 tons of metallic-lead. In 1913 they shipped 50,000 tons of ore; this could easily be very largely increased.

The Tsumeb mine (352 miles distant from Swakopmund) is the most important of the properties; less important are the Otavi Valley mine deposits in the Otavi Dolomite. Much prospecting work is being carried out in the Otavi district by the Otavi Exploring Syndicate, Ltd., of London. The Khan Copper Mine comes next in importance; it is situated some 36 miles (by rail about 44 miles) from Swakopmund. The average copper content of the ore is about 6 per cent., which is concentrated to 60 per cent. or more. The deposit is a vein, averaging 3 to 4 feet in width, of copper-bearing pegmatite. It has been opened up for a length of 1200 feet and to a depth of nearly 700 feet.

From the map appended it will be seen that copper outcrops are of common occurrence, and there is undoubtedly a field here for further investigations.

A few borings for coal have been made in the south, but so far no workable seams have been found. In the eastern part of the Protectorate the Karroo beds have been proved from about the Orange River to about Gobabis. There are indications that these beds continue into Amboland. The sandstones of Kaokoveld are also supposed to belong to the Karroo System. No borings whatsoever have been made in these parts, and the question coal or no coal is decidedly unsettled, but rather in favour of the existence of such deposits.

Diamonds were discovered in 1908, in marine and secondarily enriched alluvial deposits, which extend for a distance of about 275 miles along the southern coast. Up till August 1914 the total production amounted to about 5,400,000 carats representing a value of £9,250,000. The production has increased from 483,266 carats in 1909 to 1,470,000 in 1913. The stones are small and average 5 to the carat. The Government tax on diamonds was 66 per cent. of the amount realised for the diamonds, less 70 per cent. of the cost of production. Kimberlite (blue ground) occurs in the Gibeon, Bethany, Berseba, and Maltahöhe districts; but so far no diamonds have been proved in the different pipes and dykes.

Gold has been found in different parts of the Protectorate, but so far as we know not in workable quantity. Several auriferous quartz-veins were located in Kaokoveld at Khoabendus and Khoricas. At the latter place considerable prospecting was done; but the veins, though rich at the surface, gave out at a depth of 25 to 35 feet. Several finds at Khoabendus have so far not been exploited. To the south of Rehoboth, at Aub, auriferous conglomerates have been found, assaying from *2s. 9d.* to *4s. 2d.* per ton.

The tin discoveries (in 1911) in the vicinity of the Erongo Mountains created some sensation and large amounts were sunk in prospecting them. Results did not come up to expectations, but there are undoubtedly several deposits in this area that might be worked profitably on a small scale.

Attention must be called to the marble deposits of the Protectorate, worked by one company near Karibib. The marble is of different shades and colours: pure white, verd-antique, red striped with white veins, delicate yellowish-pink, and white with pink veins. It is very suitable for interior decoration, and it is claimed that there are deposits of white marble suitable for statuary.

Iron occurs in different parts of the Protectorate. Huge deposits of hæmatite and limonite ores have been discovered in Kaokoveld, extending into the southern part of Angola, where also magnetite ore is found. The deposits in Kaokoveld are very pure; as to the Angola deposits there are mountains of it, but of its quality information is lacking.

In 1912 there were ninety-eight mining, land, and exploration companies registered, with a capital of about £5,560,000, of which sixty-seven, with a capital of about £1,360,000, were engaged in working and prospecting for diamonds. Five companies are British, with a capital of a little over one-half of the total; of these the South-West Africa Company, Ltd., has £2,000,000 authorized capital (£1,750,000 issued). Some of the largest concessioned companies have expended considerable sums in the exploitation of their concessions, and have paved the way for the prospector by preparing good geographical and geological maps of their territories.

In 1913 the value of the mineral production amounted to about

£3,400,000, or a little more than that of Rhodesia in the same period. Considering that the mining industry in reality only dates back to 1906, the result must be regarded as very satisfactory.

The different mineral finds are shown on the appended map; and although most of them have little commercial value, they show that the country is mineralized, and there are several on which further expenditure is warranted. The German takes but little interest in prospecting, and is lacking in experience, while the alien prospector for various reasons kept aloof from the Protectorate. For the experienced prospector there is a great and undoubtedly promising field.

The white population in the beginning of 1913 amounted to 14,830, including about 2100 troops. The increase was at the rate of 700 yearly from 1900 to 1908, while from 1908–1913 it was 900. The capable farmer, the industrious man, and the man of resources, all did well. There were failures, but they were usually men who would have failed in any country. The population formed a great attachment to the colony, due to the free unrestricted life of the plains which excited the spirit of adventure and romance, a good climate, and the chances offered by the natural resources of the country.

At the beginning of 1912 the native population was approximately 239,000, the Ovambos and Hereros belonging to the Bantu race. Tables at the end show the number of the different tribes and their vocations. The total population of Amboland is about 300,000, one-half of whom live in the Protectorate. The Ovambos are kind, fairly intelligent, and industrious. About 12,000 men go south yearly in search of work, but as they work only six months at a time the actual number at work is only about 6000.

The insurrection of 1904 crushed the Herero race, who were reduced from about 60,000 to 18,000 by a policy of violence. The Herero is impertinent, arrogant and proud; he is a fatalist who takes life as it comes. Tall and well built, he is intelligent, and makes a good farm hand and mine labourer; but he needs close supervision, being inclined to sloth. Some of the Hereros remained in Kaokoveld, and go by the name of Ovatjimbas.

The Hill Damaras seem to be the remnants of a race which inhabited the mountainous part of the Protectorate. The slaves of the Hereros and Hottentots, they lived principally on vegetable food and occasional game, and claimed kindred with the monkey (Pavian). The Hill Damara is strong and well built, and makes a good servant and farm labourer.

The Bushmen are hunters, lead a migratory life, and live on meat, berries, and roots. They are small of stature and weak, but make fairly acceptable farm labourers, and are also useful for light work around mines; but generally they will not stay long at one place, as the Veld life has too many attractions.

The Hottentots are wasteful and lazy. Formerly they practised no agriculture, found great pleasure in looting, and resembled the Bushmen in their general manner of life. They are principally employed on farms, where, with good supervision, a fair amount of work can be got out of them.

The native labour question was yearly becoming more acute. A railway to Amboland would relieve the situation for some years to come, and make a difference of at least 20,000 Ovambo workmen; it would also facilitate the recruiting of other tribes living further north and east.

The Mission work dates back to 1842, and fifty-seven stations had been established; the number of native Christians was about 26,000. There were twenty schools for whites in the Protectorate, most of them having boarding accommodation.

The imports for the years 1899 to 1904 averaged £430,000 yearly, while in 1913 they amounted to £2,128,660. The exports increased from £68,580 in 1899 to £3,446,220 in 1913, £2,890,000 being about the value of the diamonds exported, and £390,000 that of copper in the year named. The military expenditure, which was defrayed by the Imperial Government, averaged yearly since 1909 £688,000; the ordinary expenditures (excluding military) averaged for the period 1912–14 £745,000; and the ordinary revenue (allowing for under-estimates on diamond revenue) about £1,060,000. The colony was (barring military expenditures) financially independent, notwithstanding an unduly expensive administration—the police vote alone amounted to £180,000—and had sufficient surplus to meet all requirements for a proper development.

There were 2300 miles of telegraph lines with ninety-five post and telegraph establishments, and the service was operated with a high degree of efficiency. The farm surveys were well advanced and probably exceeded the sales by 20 per cent. During the last few years considerable sums were expended on public works, and especially on the opening up of water by boring wells and in providing good breeding stock—stallions, bulls, rams, and wool sheep—at reasonable rates to the farmers. The yearly increase of goods-traffic (exclusive of ores) on the Otavi Railway was at the rate of 6400 tons, which gives some idea of the development in the northern and central parts.

On the whole the progress in settling the country was slow. In the last few years, when the stock farming potentialities were gradually being realized, quite a number of well-to-do Germans settled in the country. Development was hampered considerably by insurrections and warfare, lack of capital (in the case of the first settlers), and inexperience on the part of the Government and settlers. The Government did not try to encourage the man of medium and small means, an omnipotent factor in the development of all countries, and alien immigration was not favourably looked upon. The great demand of labour for the rising industries in

Germany may also to some extent explain why so few settlers were attracted. Moreover, large farms and ridiculously low land prices could only act as a deterrent to immigration and not, as intended, encourage it.

In 1907, or after the big insurrection was at an end, there were 53,000 head of cattle and 205,000 of small stock divided amongst about 450 farmers and some natives; five years later there were 171,000 head of cattle and 955,000 of small stock, and the farmers numbered about 1200. The increase is fairly good and indicates progress.

The size of the farms sold by the Government varies from 7400 acres in the north (in 1913 reduced to as low as 2500 acres) to 50,000 acres in the south. These areas are far too large, and the farms should be reduced in size by one-half or even two-thirds. In the more favourable parts of the Grootfontein district a progressive farmer can make a good living on a 500 to 800-acre farm, and here is a chance of rural livelihood for the man of small capital. The total land sales up to the middle of 1914 amounted to 32 million acres, leaving about 100 million acres still available for settlers. A land bank was established in 1913, the first effect of which was a great rise in land values.

South-West Africa is a pastoral country, and agriculture is confined to the territory around Grootfontein, Amboland, and the Okavango River valley. Since the rinderpest of 1897 the Protectorate has been practically free from serious diseases, and that stock-raising can be just as successfully and cheaply carried out here as in other parts of the world is proved by the fact that concerns like the Liebig Company and Brauss, Mahn & Company have acquired large interests in the Protectorate. In a few years the local demand for beef will be satisfied, and the Protectorate, as also the Union of South Africa and Rhodesia, will have to export their surplus to Europe. To Europe this new source of supply can only be welcome, as the demand is increasing yearly and the South American supply is being gradually diverted to the United States. It has been estimated that the area available for small stock equals that of Cape Colony, so it may reasonably be expected that in time to come the export of mohair and wool will amount to the same as in that country.

Opinions differ widely as to the population the Protectorate can support. Leaving aside the mining industry, regarding which there are good and valid reasons for optimism, I see no reason why the Protectorate should not be able to support just as large a population as the Cape Colony (at present about 600,000 whites).

The physical conditions of the Protectorate are identical with those of South Africa and Rhodesia, and political boundaries would be a great obstacle to the full and economical development of such countries. Financially it is independent, and even at this stage of considerable importance to home trade. Its natural advantages of soil, as regards grazing, and climate are indisputable, its facilities for railway construction exceptional, and its mineral potentialities decidedly promising. The man of

work, the resourceful man, can always reckon on good returns from his labour and investments.

Vocations of Male White Population.

	Jan. 1, 1900.	1903.	1908.	1912.
Government Staff } ... ... Defence Force }	801	939	{ 565 / 3988	824 / 2171
Clergy and Missionaries	41	54	79	82
Medical Men } ... ... Lawyers }	—	4	{ 9 / —	21 / 15
Settlers, Farmers, Gardeners ...	422	813	1023	1629
Engineers, Contractors, etc.	7	18	138	305
Mechanics and Miners, etc.	674	693	2123	2139
Merchants, Transport Riders, etc. ...	190	277	827	960
Seamen and Fishermen	—	6	43	29
Unclassified	11	—	488	871
Total	2146	2804	5295	9046

Nationalities of Civilian Population.

	1903.	1907.	1910.
German	2998	4929	7935
Austrian	40	247	154
British	453	973	1969
French	—	—	14
Dutch	29	94	81
Swiss	—	28	40
Swedes ... ... }	35	59	{ 27
Norwegians ... ... }			{ 13
Spanish and Portuguese	—	47	34
Italians	—	144	78
Russians	19	177	151
Danes	—	15	22
Americans	—	—	29
Unclassified	135	397	97

The native population in 1912 was approximately –

Ovambos	150,000
Hereros	20,000
Ovatjimbas	8,000
Hill Damaras	20,000
Bushmen	10,000
Hottentots	14,500
Bastards	3,500
Bechuanas	500
Okavango and Caprivi Belt natives	8,500
	235,000
Natives and coloured people from abroad	4,000
	239,000

RAINFALL IN MILLIMETRES

Means are in black type, followed by Maxima and Minima during period of observation.

	Yrs. of obs.	July.	August.	Sept.	October.	November.	December.	January.	February.	March.	April.	May.	June.	Annual.		
1. Zessfontein ...	11	0 — —	0 — —	1 5 0	4 27 0	1 8 0	17 51 0	25 139 0	21 57 *	17 47 1	12 29 0	3 22 0	* 3 0	101	281 (09)	24 (10)
2. Outjo ...	14	0 — —	1 10 0	2 12 0	9 33 0	10 26 0	64 141 10	111 241 4	88 163 10	69 126 12	32 65 0	3 20 0	1 4 0	400	662 (08)	136 (10)
3. Franzfontein	14	0 — —	* 2 0	8 87 0	4 37 0	8 31 0	35 135 0	55 150 0	59 138 6	59 198 3	28 89 2	2 14 0	* 6 0	237	399 (09)	129 (10)
4. Grootfontein	14	0 — —	* 8 0	2 18 0	16 78 0	40 85 3	115 218 2	155 362 5	128 201 32	96 171 32	47 142 0	4 35 0	3 36 0	598	964 (08)	220 (10)
5. Okombahe ...	10	* 1 0	0 — —	6 51 0	6 63 0	5 14 0	22 59 0	50 218 1	29 68 1	26 62 1	13 36 1	* 4 0	1 12 0	160	294 (04)	60 (10)
6. Omaruru ...	16	* 1 0	0 — —	2 26 0	6 32 0	6 25 0	33 119 0	88 246 0	72 204 11	37 124 7	32 84 1	3 16 0	1 11 0	281	590 (08)	63 (10)
7. Karibib ...	12	* * 0	* 8 0	1 16 0	3 31 0	2 6 0	34 164 3	50 173 0	52 100 4	25 50 0	12 57 0	3 26 0	* 3 0	172	363 (11)	74 (00)
8. Otjimbingue	13	* 2 0	0 — —	2 17 0	2 24 0	4 24 0	24 87 0	53 137 2	45 197 *	27 100 1	13 42 0	3 30 0	* 3 0	171	387 (04)	59 (00)
9. Okahandja ...	19	* 8 0	3 35 0	1 16 0	11 60 0	11 64 0	60 134 1	87 234 5	97 277 10	78 169 9	33 104 0	7 38 0	* 3 0	387	747 (92)	137 (10)
10. Gobabis ...	16	1 11 0	1 8 0	2 9 0	11 52 0	28 71 1	58 120 8	112 247 8	91 184 8	69 266 12	30 128 0	7 33 0	2 30 0	411	656 (08)	129 (12)
11. Aminuis ...	14	3 18 0	1 10 0	5 34 0	3 19 0	10 49 0	39 73 2	53 126 8	73 211 0	41 127 *	30 100 2	8 76 0	1 7 0	260	483 (08)	112 (12)
12. Windhoek ...	23	1 30 0	2 45 0	1 16 0	9 39 0	21 113 *	50 159 6	93 309 2	23 178 0	78 241 7	40 139 0	6 43 0	1 6 0	376	757 (08)	185 (01)
13. Hohewarte	16	2 27 0	0 — —	1 16 0	6 25 0	13 58 0	47 127 8	83 185 0	74 140 12	61 284 7	34 114 2	10 46 0	1 11 0	331	808 (08)	138 (12)
14. Swakopmund	15	* 1 0	* 6 0	* 3 0	1 9 0	* 6 0	3 15 0	3 20 0	2 13 0	3 16 0	1 6 0	10 11 0	* 4 0	16	29 (01)	3 (06)
15. Rehoboth ...	25	* 2 0	2 59 0	2 44 0	6 22 0	12 86 0	26 88 *	66 248 1	60 208 1	49 138 2	25 78 0	4 40 0	1 10 0	248	599 (92)	76 (12)
16. Nauchas ...	13	* 6 0	* 3 0	1 10 0	6 35 0	5 33 0	37 132 1	56 225 *	51 130 0	26 76 0	23 90 1	2 12 0	1 10 0	202	498 (08)	65 (02)
17. Maltahöhe ...	13	1 7 0	0 — —	2 16 0	2 12 0	4 36 0	10 29 0	44 169 *	29 64 1	27 71 1	23 105 0	1 8 0	* 2 0	135	307 (08)	48 (12)
18. Gibeon ...	15	* 2 0	* 2 0	1 11 0	4 22 0	10 92 0	10 32 0	40 182 *	37 85 *	26 66 *	12 64 0	1 7 0	1 12 0	141	340 (98)	52 (00)
19. Beersheba ...	12	0 — —	* 1 0	2 23 0	1 5 0	3 16 0	9 33 0	13 37 0	25 66 0	22 78 6	9 40 0	* 4 0	* 1 0	81	177 (08)	9 (01)
20. Bethany ...	15	* 3 0	1 13 0	1 6 0	2 29 0	4 32 0	9 44 0	28 105 0	22 62 0	28 93 *	14 70 0	2 16 0	2 24 0	111	231 (03)	30 (05)
21. Keetmanshoop	15	2 20 0	2 1 0	1 8 0	4 30 0	5 16 0	8 37 0	24 116 0	30 70 1	29 77 7	17 63 0	2 10 0	1 5 0	121	259 (03)	23 (07)
22. Hasuur ...	12	* 5 0	1 12 0	* 4 0	2 16 0	18 113 0	16 42 0	37 121 *	38 139 3	57 181 0	10 50 0	8 37 0	4 20 0	185	653 (06)	9 (07)
23. Lüderitz Bay	11	1 3 0	3 16 0	2 15 0	* 2 0	* 1 0	1 6 0	* 2 *	1 17 0	1 4 0	1 4 0	9 20 0	4 15 0	18	37 (04)	5 (11)
24. Ukamas ...	12	5 25 0	2 20 0	1 7 0	5 38 0	8 33 0	11 31 0	15 85 1	21 73 6	33 164 *	17 70 0	4 24 *	4 25 0	119	283 (99)	23 (07)
25. Warmbad ...	14	4 16 0	1 6 0	2 13 0	3 14 0	2 12 0	2 11 0	10 65 0	22 68 *	20 52 *	17 61 0	2 11 0	5 19 0	88	214 (98)	9 (07)

(09) = 1909–10.
(10) = 1910–11.

* means a few tenths of a millimetre.

According to an enumeration made in 1913 the natives in employment were classified thus:

Tribe.	Transport riders.	Farmers.	Domestics.	Labourers.	Convicts, invalids and labourers employed by other natives.	Employed by Government.	Total.
Hereros	51	3	4,006	1,354	99	952	6,465
Ovambos	13	—	581	4,475	11	56	5,136
Hill Damaras	118	4	3,309	969	513	395	5,308
Hottentots	374	36	2,521	323	534	501	4,289
Bastards...	322	8	247	71	199	43	890
Bushmen	3	—	747	130	36	81	997
Bechuanas	95	—	43	1	—	3	142
Totals	976	51	11,454	7,323	1,392	2,031	23,227
Natives and coloured persons from abroad (mostly Cape boys)	6	—	563	3,289	1	64	3,923
Totals	982	51	12,017	10,612	1,393	2,095	27,150

EARLY DUTCH EXPLORATION IN SOUTH AFRICA

Reizen in Zuid-Afrika in de Hollandse Tijd. Uitgegeven door Dr. E. C. Godée Molsbergen. Eerste, Tweede, deel, Tochten naar het Noorden, 1652–1686, 1686–1806. (Werken uitgegeven door de Linschoten-Vereeniging, xi., xii.) The Hague: Martinus Nijhoff, 1915–16. *Maps and Plates.*

THE early history of exploration in the interior of South Africa has attracted less attention perhaps than that of most other parts of the world. The reason probably is that the extension of knowledge was a slow and gradual process, and was not bound up with the solution of any striking geographical problem, nor with the conquest of any rich countries promising immediate commercial advantages to European nations. Still the story is well worth the telling and deserves to be better known than it is to the present-day successors of the early pioneers. It is hardly realized to what extent the interior of the country, to some distance beyond the Orange River, had been brought to light by the persevering efforts of the Dutch adventurers (efforts rendered difficult by the inhospitable nature of much of the country) before the cession of the Cape to Great Britain. To rescue their achievements from oblivion is the aim of the Linschoten Society in undertaking the publication of a series of volumes, of which the two quoted above are a first instalment, treating of explorations towards the *north* down to the close of Dutch rule in South Africa in 1806.

These volumes are ably edited by Dr. E. C. Godée Molsbergen, who brings to the task abundant enthusiasm coupled with the industry necessary to sift out the material from the voluminous Dutch records bearing on

South African Colonial History. The task was far more formidable than that involved in the editing of most other publications of the kind, for the editor had to do not with a limited number of narratives to be merely reprinted and annotated, but with a vast body of records of varying importance, the gist of which, from the standpoint of geographical exploration, had to be incorporated into a more or less continuous narrative. At the same time the more important records deserved to be printed in full, and this has been done in the case of just twenty documents, which are printed from time to time (in large type) in their proper chronological sequence. The connecting links in the story are either in the form of much-condensed summaries, or are supplied by the editor in his own words, and are printed in slightly smaller type. In this way undue repetition of dry detail is avoided. Copious footnotes give references to the original documents or elucidate special points. Attention is given now and again to the growing body of place-names occurring in the records, and much light is thus thrown on the origin and true form of many names, since changed or corrupted, of which the history has hitherto been obscure.

The first part of the first volume, occupying more than half the total space, treats of one or two early visits of Dutch navigators to the Cape during more extended voyages, and of the first efforts of the settlers to acquire such knowledge of the interior and its resources as might help to make something more of the possession than a mere port of call on the way to the East. Progress during the seventeenth century was but slow, and no great advance had been made down to the great expedition of the Governor Simon van der Stel in 1685–86. Still, something had been done in the way of opening intercourse with the Hottentots and Bushmen, and the narratives printed are specially valuable for the information they supply on the condition and mode of life of the former before modification by contact with civilization or the decimation of some of the tribes by the epidemics which broke out later. Some of the expeditions were undertaken with a view to obtaining cattle and other supplies for the use of the settlement or the ships which touched there during the voyage to the East. Others, like those of Dankaert, Cruythoff, and Meerhoff, had a more ambitious aim, being made in the hope of discovering a way to the supposed powerful empire of "Monomotapa," which exercised on the minds of the Dutch pioneers from the south an influence similar to that which enticed the Portuguese into the interior from the south-east. The journals of the two last-named expeditions are printed in full, and are of interest in spite of their failure to realize the hopes of their promoters. Their small success caused discouragement, and in 1664 we find that the Governor and Council wrote home urging that no more difficult and dangerous journeys into the interior should be undertaken. Yet in 1669 came the mission of Hieronymus Croes to the "Obiquaes" and "Hessequaes," which had results of some importance as bringing the settlers into closer relations

with the interior tribes, more Bushmen than Hottentots. Some efforts were also made, in response to orders from home, to open an intercourse with the "Caffres" in the more distant interior, but they were without much result. Collisions occurred with the Hottentots about this time, but were brought to an end by the treaty concluded in 1677.

The latter part of the first volume is taken up with the narrative of Simon van der Stel's well-known expedition above referred to. It was successful in opening a way to the "Koperberg," the copper region south of the lower Orange River, on the exploitation of which great hopes were built at the time, though the distance of the mines and the want of suitable transport rendered these hopes illusory. The narrative of this expedition is reprinted from the great collection of Valentyn (vol. 8, 1726), to whom we owe its preservation for posterity, as no copy is now to be found in the Dutch archives.

With the narratives printed in the second volume, the geographical interest in the story is heightened by the greater extent of country traversed, and much new information is placed on record regarding the country, its people, and fauna. Journeys were now made with a view to hunting the big game, and it was one of these—that of Jacobus Coetsee Jansz in 1760—that led to the first reaching and crossing of the Orange River, and contact with the "Great" Namaquas to the north of it. They had crossed to the northern side only some twenty years earlier, according to Coetsee's statement. This journey had as its direct result the still more important one of Hendrik Hop, sent in 1761 to continue exploration in this direction. The narratives make frequent reference to the meeting with and hunting of the giraffe ("Cameel" of the colonists), and show that, like the elephant, this animal was already in course of retreat to more remote districts. Another narrative printed in full records the adventurous wanderings of Hendrik Jacob Wikar in the remoter parts of the interior, and others are concerned with the more important and better-known expeditions of the Van Reenens, which considerably extended the Dutch knowledge of the country north of the Orange River up to Walvis Bay and beyond.

It would have added to the value of the collection could a detailed narrative have been given of the various journeys carried out by the interesting but somewhat elusive personage Colonel R. J. Gordon, a Dutch official of Scottish extraction who had so identified himself with the fortunes of his adopted country that he committed suicide on receiving the news of the cession of the Cape to Great Britain. He was an enthusiastic naturalist, and his name is commemorated by the South African plant known as *Stapelia Gordoni*, as well as by "Gordon Bay" and the district of "Gordonia." It is to him that we owe the naming of the Orange River, the mouth of which he reached for the first time (with Paterson) in August 1779. He had also been the first to sight the confluence of the Vaal with the upper main branch of the river two years earlier. Dr. Molsbergen

mentions these and other particulars about him in a note, but, though he does not positively say so, it is to be presumed that no detailed records of the journeys are in existence. The present volumes owe to him, however, an important feature for which our thanks are due, nearly all the plates being facsimile reproductions of drawings from the "Gordon Collection" lately acquired by Holland, after finding a home in this country for many years. Curiously enough, though referring incidentally to this collection in the prefaces to the two volumes, it is only in the footnote on the author of the drawings (in vol. 2) that the editor explains the history of the collection. Those interested in such matters will remember that it was advertised for sale by Messrs. Maggs Brothers three or four years ago, having been till then in the Duke of Sutherland's Library. Through the energetic action of Dr. H. P. N. Muller and a committee formed in Holland it was secured for that country in 1914 and is now in the "Rijks Prentenkabinet" at Amsterdam. The drawings are of special interest and value, and supply an excellent illustration of South African natives, places, and animals as known to their author, who was the first to send good drawings of the giraffe to Europe. The present volumes also include reproductions of an old drawing of Table Bay (apparently the one used by Valentyn for his collection) and of Simon van der Stel's map of his route to the copper district. Each volume has an analytical table of contents and a good index, and their general get-up is admirable.

E. H.

THE TRACK OF THE TOTAL SOLAR ECLIPSE, 1919, MAY 28–29

AT the meeting of the Royal Astronomical Society on March 9 the Astronomer-Royal called attention to the particular importance of the total eclipse of the sun which will be visible on 29 May 1919, civil date. The duration of totality is long, and the sun is, at the moment of eclipse, in the midst of a group of bright stars, which will provide an excellent opportunity of determining whether light-rays passing near the sun are deflected in accordance with the gravitation theory of Einstein—a question of extreme importance in the present state of astronomical speculation. The eclipse passes over the basin of the Amazon, the Atlantic Ocean, and the basin of the Congo to Tanganyika, and it is clearly a matter of some difficulty to select along this track the most suitable places for the establishment of observing stations. It is therefore desirable to collect information as to local conditions well in advance of the time when, if the war is over, it may be possible to send astronomical expeditions for this important observation. The following table, abbreviated from the Nautical Almanac for 1919, p. 421, gives the positions of points on the central line of totality :—

CENTRAL LINE OF TOTALITY 29 MAY 1919.

Latitude.	*Longitude.*	*Latitude.*	*Longitude.*
S. 5 3·2	W. 43 28·9	N. 4 41·2	W. 11 43·5
3 47·9	40 54·2	4 39·9	10 8·4
2 41·3	38 34·0	4 35·3	8 31·4
1 41·9	36 24·9	4 27·3	6 52·1
0 48·5	34 24·3	4 15·5	5 9·8
S. 0 0·3	32 30·4	3 59·9	3 24·0
N. 0 43·1	30 41·9	3 40·1	W. 1 33·8
1 22·2	28 57·7	3 15·7	E. 0 21·6
1 57·2	27 17·1	2 46·3	2 23·3
2 28·5	25 39·2	2 11·3	4 32·8
2 56·2	24 3·6	1 29·8	6 52·2
3 20·5	22 29·6	N. 0 40·6	9 24·4
3 41·6	20 56·8	S. 0 18·1	12 13·5
3 59·4	19 24·8	1 29·2	15 26·3
4 14·0	17 53·2	2 57·9	19 15·2
4 25·5	16 21·6	4 55·6	24 7·6
4 33·9	14 49·8	8 1·9	31 40·4
4 39·1	13 17·2		

Possible stations would seem to be in the State of Ceará, Brazil; the Island of Principe; in the neighbourhood of Libreville, French Congo; and on the western escarpment of Tanganyika. The most important conditions for an eclipse camp are that there shall be a good chance of clear sky on the day of the eclipse and for several weeks beforehand; that the place shall be reasonably accessible, with means of transport for heavy instruments; that there shall be available local labour and materials for the construction of huts and the foundations for instruments; and that there shall be a good supply of pure water for photographic work. It adds much to the convenience of the party if it can be installed in existing buildings instead of having to camp, and if supplies and local hospitality are available.

The most favourable station in Brazil is perhaps on the interior plateau of the State of Ceará, which is described as quite healthy, and with less rain than on the coast or in the Amazon basin. The town of Sobral is about 10 miles south of the central line, and Santa Anna is almost upon it. These have connection by railway with the port of Camocim. The rainy season is described as lasting from February to June, but the rains are intermittent and sometimes fail altogether.

St. Paul's Rocks, in the Western Atlantic, are near the central line, but almost certainly unsuitable for the establishment of a station. They are described in the narrative report of the *Challenger* Expedition as volcanic, topped with guano, the highest 64 feet above high water, with no fresh water except in the rainy season, constant rollers, with confused sea and no anchorage.

The central line cuts the coast of Liberia a few miles inside Cape Palmas (the diagram in the Nautical Almanac is incorrect here); but the rainfall at Cape Palmas is said to be about 100 inches. The dry season is short, from December to February, and during the rains much of the coast country is under water. Prospects in Liberia are therefore poor.

The Island of Principe lies some 20 miles north of the central line, and the length of totality is therefore diminished, but in many respects it offers facilities for the establishment of an expedition, having good landing jetties, light railways, and large plantation buildings, especially in the north of the island. There seems to be little information as to the weather in May, and as to facilities south of the central peak and nearer the central line of the eclipse.

Libreville, the capital of French Equatorial Africa at the mouth of the Gabon, lies about 18 miles south of the central line; but there are hills a little way inland, north-east of the town, which might provide good stations. The rainy season is coming to an end in May, and local information as to conditions here is very much to be desired.

Eastward from Libreville across the Congo forest the conditions are probably hopeless until one reaches the high land west of Tanganyika, where the eclipse takes place late in the afternoon, and special care would be required in the selection of a station with a good western horizon and freedom from low-lying haze. The central line runs between the large mission at Baudouinville and the smaller at St. Jacques de Lusaka. At Baudouinville there is a large establishment of the White Fathers, with extensive gardens and many natives in training as mechanics. From information given us by M. Charlier, who has lived in the district, we understand that the rains generally end in April and that the sky is clear in May, though perhaps getting hazy towards the end of the month with the advent of the dry season. Sleeping-sickness, which was bad in the district some years ago, has much decreased; and Baudouinville is easily accessible *vid* Dar-es-Salaam, Ujiji, and the lake steamers which call at Port St. Louis on the shore of the lake some 1100 feet below Baudouinville itself.

The circumstances of the eclipse for these stations have been computed by Mr. A. C. D. Crommelin of the Royal Observatory, Greenwich, and are as follows:

	Sobral.	S. of Principe.	Libreville.	Baudouinville.
Duration of totality ...	$5^m\ 14^s$	$5^m\ 13^s$	$5^m\ 7^s$	$3^m\ 32^s$
Local mean time ...	9.19 a.m.	2.45 p.m.	2.58 p.m.	4.43 p.m.
Altitude of Sun	43° 55′	44° 18′	41° 10′	14° 25′

At the request of the Astronomer-Royal we have undertaken to collect information which may assist the British Government expeditions, should it be possible to dispatch them. We shall be grateful to any correspondents who may be so good as to send us advice in this matter. It would be particularly useful to have observations on rain, cloud, and haze at different times of day collected during the months of May this year and next in the neighbourhood of the above-suggested stations.

A. R. H.

REVIEWS

EUROPE

The Reconstruction of South-Eastern Europe.— **Vladislav R. Savić.** London: Chapman & Hall. 1917. Pp. vi. and 280. *Price 7s. 6d. net.*

THIS volume, which has a preface by Sir James Frazer and contains Sir Arthur Evans' "Diagrammatic Map of Slav Territories East of the Adriatic," which has already appeared in the *Journal*, is devoted mainly to Serbia and the Southern Slavs on the ground that the Yugo-Slav problem is the crucial one in the region. It consists, in fact though not in form, of three parts: a history of the Southern Slavs and their relation to Austria-Hungary; an account of the Serbian campaigns during the present war; and a discussion of desirable future frontiers, and of the destiny and commercial possibilities of the great Yugo-Slav state which the author hopes to see founded at the close of the great war. Its purpose is the very sound one of enlightening the public here in regard to the conditions which prevail in South-Eastern Europe.

X

In regard to the historical sections of the book we need say little, for since the author frankly states that his book is written with the object of defending a particular solution of the difficult problems offered by South-Eastern Europe, the impartial reader will naturally be on the watch for possible unconscious bias in historical judgments. The historical chapters are, in point of fact, of interest as representing a point of view which has not hitherto been given much publicity in the English language.

The third section includes a general discussion of frontier problems, in the course of which the author declares himself a convinced opponent of the doctrine of strategic frontiers as a dangerous snare. "The best strategic frontiers for every nation are the friendship and amity of its neighbours, and in case of danger brave hearts and a good cause." It is not, therefore, without some sense of shock that one finds later in the book that the future great Yugo-Slav state, with 14,000,000 inhabitants and a territory of 100,000 square miles, requires protection against a Bulgaria containing 4½ million people. "The future frontiers of Serbia and her railway lines running through the Timok and Vardar valleys, being the arteries of Serbia, must be protected by a larger belt of territory." The Isker valley (*i.e.* a line east of Sofia?) is mentioned a few lines lower down as marking the limit of a region which "has always tended towards Serbia." Rumania is also to be asked to make sacrifices on the ground that "neither economically nor *strategically*" (the italics are ours) does she need the Banat as badly as Serbia does.

Further, "the aspirations of the Southern Slavs rightly go beyond the Southern Serbian frontier"—as those of other peoples are apt to do. The aspirations in the sentence just quoted refer to lands which are at present Greek; but Bulgaria, Rumania, and Greece are not the only countries which in the author's opinion might reasonably give up territory to ensure "a new and brighter era of humanity," and to enable the Southern Slavs to "set up their ideal of love and Christian humility." Italy also is urged to avoid the dangerous snare of the strategic frontier.

The earnest patriotism of the author has produced an interesting and useful book; but we must recognize that his solution of the problem of South-Eastern Europe is partisan.

M. I. N.

ASIA

The History of Kathiawad from the Earliest Times.— Captain H. Wilberforce-Bell. London: Heinemann. 1916. *Sketch-maps.* *12s. 6d. net.*

The peninsula of Kathiawad, like other Indian frontier districts, has the reputation of exercising a peculiar attraction upon those who have spent enough time there to become well acquainted with it, especially if, like the author of this work, they have been brought into intimate contact with the life and politics of its people. The interest lies not merely in the variety of the races there represented, but also in the fact that the whole country is under its native chiefs, from the ruler of 4000 sq. miles to the lord over half a dozen villages. Every chieftain is the descendant of ancestors who fought or intrigued their way to power until secured in their rights by the British Government little more than a century ago. In its geographical features the peninsula is tame, flat, ill-wooded, ill-watered, and except along the south-eastern coast not particularly fertile. A few scrub-clothed low ranges have been from time immemorial a godsend to outlaws, ejected chiefs, and other broken men. Two detached peaks spring imposingly from the plain, and there is one forest,

"where be lions." On the other hand, it has harbours and roadsteads, and for centuries has been traversed by successive waves of immigrants seeking the sea and its commerce. It is this foreign leaven which has contributed the most interesting element in its history as in its ethnology. Most of the early events are known from tradition only, but probably took place, though in some form widely differing from that commending itself to the bards and chroniclers of posterity. The unravelling of this tangled skein has made much progress in the last forty years, and the author has been able to use material not available to all his predecessors, and has dealt faithfully on the whole with the mass of legend and hypothesis before him. The absence of natural boundaries, and the multiplicity of the independent chieftains of different races or tribes, invited territorial aggression in old times, and the greater part of the annals, accordingly, relates to a long series of fraud and intrigue—in which the ladies of the little court took their fair share—and of sterner measures of usurpation, conducted with a barbarity almost equal to that of a twentieth-century German. The work is addressed primarily to the local chiefs, who can easily see from it that the conduct of their respective ancestors of long ago compares not unfavourably with that of their neighbours. To the general reader the two chapters on the three leading men of the latter part of the eighteenth century may be commended, as the appreciative and well-written account there given is fairly typical of the general lines of Kathiawadi annals. To this should be added the later chapters on the remarkable advance made by the peninsula in the last half-century. Captain Wilberforce-Bell's narrative has not the charm of the Ras Mala, but it is far more comprehensive, and embodies the corrections necessitated by the discoveries of Jain manuscripts and inscribed copper-plate grants. J. A. B.

GENERAL

Alfred Russell Wallace. Letters and Reminiscences.— James Marchant. *With 2 Photogravures and 8 Half-tone Plates.* 2 vols. London: Cassell & Co. 1916. *25s. net.*

The Letters and Reminiscences of A. R. Wallace are contained in two volumes of some 300 pages each. In the first of these we are presented with a contrast between the early years of Wallace and Darwin; some 40 pages of letters written from Malaya during the period 1854–1862, addressed to his relatives, chiefly his mother; an account of the "Discovery of Natural Selection," and the "Complete extant Correspondence between Wallace and Darwin (1857–1881)," extending to 93 pages. The second volume deals with Wallace's literary work, and his "Correspondence on Biology and Geographical Distribution," followed by a short account of his home-life written by his son and daughter, and by chapters on Wallace's views on social and political questions as well as on astronomy and spiritualism, concluding with a short summary of "Characteristics" by the editor.

The imperishable contribution made to science by Wallace as the independent propounder of natural selection some fifty-eight years before the date of the present book, is as well known as any epoch-making event in history. His share in the Darwinian theory is told in Darwin's 'Life and Letters'; in Wallace's own autobiography with great fullness; as well as recounted in the *Proceedings* of the Linnean Society on the fiftieth anniversary of the reading of the papers announcing the theory. The present two volumes might therefore, we think, have been compressed with advantage into one. By the excision of the "Early Letters" we should have lost few, if any, features of his personality

not presented in his own account, while the letters to and from Darwin have been so long before the world and so universally read that the few additions are hardly important enough to have called for the reprinting of the entire correspondence. One letter we strangely enough miss everywhere is the historical epistle in which Hooker informed Wallace of the motives for reading his and Darwin's papers to the Linnean Society simultaneously. The most interesting portion of the present book is that containing Wallace's correspondence—heretofore unpublished, we believe—on "Biology and Geographical Distribution," with Spencer, Lyell, Hooker, Poulton, Meldola, Dyer, and others. The family contribution is very pleasant to read, for it makes us more intimately acquainted with the man than the 'Correspondence' or even 'My Life' does. What is surprising in Wallace's career is his attitude to such questions as vaccination, vivisection, and his opinions about malaria (p. 241). In his own branch of science he was logical, far-seeing, quick to apprehend evidence and to arrive almost intuitively at right conclusions; yet on these subjects, with statistics and proved results and the opinions contrary to his own of the very highest authorities in a department of knowledge in which he could only be an amateur, he showed himself so "blind to the plainest deduction from facts" as to dogmatically denounce vaccination as "quackery." Wallace was a firm believer in phrenology as "the true science of mind." Contrasting the strong, staid, unemotional features and high frontal of Darwin with the somewhat petulant face and less elevated cranium of Wallace, a non-phrenologist even might be tempted to deduce that the former had a sedate nervous system and a more evenly balanced mind (greatly due no doubt to heredity, but amplified by that incomparable educator, a university training) than the latter. Wallace's was a highly sensitive nature, and his judgment—always outside the biological domain in which he was so pre-eminent—was easily led astray from over-sympathy and "excess of imagination" due evidently to latent prejudices acquired in early life. Wallace's attitude to spiritualism is well known. The kink in his mind which led him to "sin against the light" in regard to vaccination seemed to cause him to lose the true critical faculty and to accept with trusting innocence much that required better proof than as yet exists. That "Wallace lived to see the theory of evolution applied . . . to the origin of consciousness and life . . . a conception which has completely revolutionized men's attitude towards himself and the world and God"—a judgment affirmed by the Editor in his 'Characteristics of Wallace'—will scarcely meet with acceptance by the majority of the men of science, as yet. The book is Wallace's 'My Life' with amplifications—none very important or essential—by the editor, who has sympathetically and skilfully re-pieced together the life and labours of the great naturalist.

Wallace is buried in Broadstone cemetery, but a memorial medallion, subscribed for by his friends, has been erected in Westminster Abbey—as was his due—near to those of his great compeers, Darwin, Lister, and Hooker.

THE MONTHLY RECORD

EUROPE

Pastoral Migrations in the Dinaric Region.

ONE of the most attractive studies in human geography is that of the periodic migrations of pastoral people in obedience to the need of finding pasturage for their flocks at a distance from their homes at certain seasons of the year.

More or less neglected until recent years, it has begun to be studied systematically of late, and several papers on the conditions of "Transhumance"—the French word by which the custom has come to be generally designated—have already been noticed in the *Journal* (vol. 36, p. 490; vol. 40, p. 213; vol. 41, p. 64). The latest contribution to the subject is a paper by Jevto Dedijer on 'Transhumance in the Dinaric countries,' in the *Annales de Géographie* for 15 September 1916. While the custom is a general characteristic of the Mediterranean region by reason of its climatic peculiarities, a great variety of forms is to be traced within the region in accordance with varieties of relief or climate; and it is a special merit of M. Dedijer's study that it brings out the influence in detail of local conditions (morphological or climatic) within the area studied. This is the zone of mountainous country running roughly parallel with the Adriatic on the east and separating it from the interior basin of "Pannonia." The arid nature of much of the lower ground on the Adriatic side by reason of its "karst" formation renders the summer migration of the flocks and herds particularly necessary in this tract. M. Dedijer divides the whole zone into three longitudinal belts, corresponding to the two versants and the central region of greatest elevation where Transhumance properly speaking does not occur. The Adriatic versant, again, may be triply subdivided, there being an intermediate zone (between those of the permanent villages and the summer châlets) capable of habitation throughout the year, where migration in summer is not necessary. It thus comes about that the migrating population actually passes through the habitat of the sedentary population on the way to the summer pastures. Local conditions, such as the existence of a mountain above a certain elevation within the domain of a permanent village, may in certain cases obviate the necessity of any migration; and on the other hand special circumstances of climate or water-supply may involve a complex movement both upwards and downwards, such as that between the *poljes* and the mountains surrounding them. In other cases the movement is by definite stages with halts of some duration between. It is impossible even to mention the many special forms discussed by the writer, who, in treating of the central zone of greatest altitude, enters into questions such as the altitudinal limit of the villages, the location of the châlets, and so on. It is noteworthy that, whereas the permanent villages tend to ascend to greater heights, the migatory people show an opposite tendency. On the interior versant the migrations are in an opposite sense to those on the Adriatic side, viz. from high-level villages to pasturages at a lower level, and they take place not in summer but in spring and autumn. In conclusion, the writer touches briefly upon the interrelations between social and religious conditions and the migrations in question.

ASIA

Punjab River-names in the Rigveda.

Sir Aurel Stein has an interesting note in the *Journal of the Royal Asiatic Society* for January 1917 on certain of the river-names occurring in the *Nadistuti* or "Song of the Rivers" in the Rigveda, which are of special value as an indication of the area occupied by, or known to, the Indo-Aryan people who produced the oldest Indian literary remains. Those dealt with all occur in a single verse and relate chiefly to rivers of the Punjab to which Sir Aurel's attention was directed when working in that province many years ago. The identity of the first four admits of no doubt, their names being easily recognizable as those of the Ganges, Jumna, Sarasuti, and Sutlej. One of the others—the Vitasta—is evidently the Jehlam (the ancient Hydaspes, still

called Vyath in Kashmiri). The identity of the next three is less obvious, but as the sequence of the easily recognized rivers is geographical from east to west, there is a clue to the location of the others, which are to be looked for between the Sutlej and the Jehlam. The *Asikni* had already been identified with the Chenab or Candrabhaga (the classical *Akesines*), and there is at least a probability that the *Parusni* represents the modern Rawi. The third name is the *Marudvrdha*, which figures between the Asikni (Chenab) and the Vitasta (Jehlam), and Sir A. Stein points out that we must look for it either among the western main feeders of the Chenab or among those which join the Jehlam from the east. Among such affluents the most important is the glacier-fed river which joins the upper Chenab in the Alpine territory of Kishtwar, and in the Survey of India maps this is shown as the "Maroowardwan"—a name which, Sir A. Stein shows, is a direct derivative, by phonetic laws, of a form closely linked with the Vedic Marudvrdha (with the addition of a determinative *wan* derived from *vana*, "forest"). The name is of interest on other grounds, as its two main elements are applied independently to the hamlets in the two main branches of its valley. A similar splitting up of a river name to denote its upper branches occurs in the case of the Candrabhaga, and also, far to the south, in that of the Tungabhadra, and Sir A. Stein suggests that such a practice is probably widely spread. Of the two other names mentioned in the Vedic verse the *Susoma* is probably the Sohan, as suggested by Vivien de St. Martin, but no survival of the name *Arjikiya* can yet be made out, though the river intended might be looked for among the right-bank tributaries of the Jehlam before this emerges from the mountains. The exact geographical knowledge indicated by the verse, extending over a wide range of country, is at first sight surprising, but parallels can be found in the accurate knowledge of a wholly empiric kind often displayed by illiterate wanderers—pilgrims, traders, and the like—at the present day.

AFRICA

The Climate of Ghadames Oasis.

Prof. Filippo Eredia of the Italian Meteorological Office has contributed to the *Bollettino Informazione del Ministerio delle Colonie*, Numeri 4–5–6, 1916, a valuable study of the climate of the Ghadames oasis in the south of Tripoli (lat. 30° 7′ 48″·7 N., long. 7° 9′ 57″·9 W., altitude 340 metres or 1115 feet). The locality is visited by few Europeans, and the meteorological record is of a very fragmentary character; but from observations made by Duveyrier during a sojourn in 1861, from notes taken by L. Pervinquière whilst accompanying the Boundary Commission of 1911, and from a continuous meteorological record inaugurated by the Italian Government's Tripoli Expedition in 1913 and 1914, a good deal of information has been gathered, sufficient at all events to show the general features of the climate. In summer it appears to be quite a normal thing for the thermometer to mark 122° F. (50° C.) in the shade, so that the climate may well be described as "cocente." In the colder months, however, the early morning hours may be distinctly cold, and Pervinquière in 1911 observed a minimum as low as 28°·4 F. (−3° C.), or nearly four degrees of frost. From a comparison of the observed thermal peculiarities of the climate of Ghadames with those of the city of Tripoli, where a lengthy meteorological record exists, Prof. Eredia estimates with some confidence the average mean temperatures for the several months. Upon this estimate the hottest month is August, with a mean air temperature of 92°·8 F. (33°·8 C.), as against 75°·5 F. (26°·4 C.) at Tripoli on the sea-coast 500 km. (300 miles) farther

north—a value in better agreement with the mean July or August temperature in the heated plains of Italy. The coldest month at Ghadames is January, with a mean of 51°·9 F. (11°·1 C.), which is a little below that of the maritime district of Tripoli, but some four or five degrees above that of Rome or Naples. In connection with the high temperature of the air it is interesting to note the small average amount of cloud, permitting unchecked solar radiation. There are 251 days in the year which are perfectly clear, 102 partly clear, and only 12 overcast, all of the latter being distributed over the five cooler months, November to March. In July, on the other hand, there are 29 cloudless days out of the 31, so that the resulting intensity of heat can be easily understood. For the rainfall and other climatological elements in the oasis the data are still scanty. Sudden bursts of heavy rain occur occasionally, but so long a period as ten years may elapse without a drop. The special interest of the climate to Europeans would seem to depend on the characteristics disclosed with respect to heat, drought, and serenity.

AMERICA

The Torngat Mountains, Labrador.

One of the least traversed parts of British North America is the mountainous belt which forms the northern extremity of the outer side of the Labrador Peninsula. Although of no great height (probably nowhere exceeding 6000 feet, though once supposed to reach 10,000), these mountains offer some attractions as a climbing ground even to the professed mountaineer, by reason of the rugged nature of the district and the comparative severity of the climate. In his paper on Labrador read before the Society in 1911 (*Journal*, vol. 37, pp. 407 *et seq.*) Dr. Grenfell referred to this mountain belt as constituted by three great ranges of which the most northern, lying between Cape Chidley and Saeglek Bay, was spoken of by him as the "Torngaks or Devils," affording the "highest and wildest scenery along the whole coast of Eastern North America." A recent visit to this group and first ascent of one of its most prominent peaks are described by Prof. A. P. Coleman, whose explorations and ascents in the Canadian Rockies are well known to geographers, in the volume of the *Canadian Alpine Journal* for 1916. He also has a second short paper on "The building of the Torngats" in the scientific section of the same volume. Both papers are illustrated by Prof. Coleman's own photographs. He points out some of the most striking differences between the physical nature of a comparatively youthful and simple range like the Rocky Mountains and a very ancient region like that of Labrador, where the problems of geological history are much harder to solve, the original strength of the rocks having very little relation to the present mountain forms. The steeply tilted gneisses and schists of Labrador form a surface representing the worn-down remains of great ranges of mountains, once probably higher than the Rockies. The old Archæan plain so formed suffered an uplift of thousands of feet, accompanied by great faults which let down the eastern part beneath the sea, the remainder facing the Atlantic with a steep escarpment. The Torngats are thus the remnants of a pre-glacial plateau which was too lofty to be overridden by the great Labrador ice-sheet, but has been eaten into by local glaciers. These have left very steep-walled basins and short valleys in the outer parts, while dome-like surfaces are more prevalent in the interior. At present the glaciers are small and not very active, frost and running water being the chief sculpturing agencies. The peak climbed by Prof. Coleman was named by him Mount Tetragona, and an aneroid reading gave its height as 4700 feet. The view from the top was wide

and splendid, but, as the district is north of the timber-line, embraced one of the stoniest and most desolate regions in the world.

Dr. Hamilton Rice's New Expedition.

Writing from Santa Isabel on the Rio Negro on January 24 of this year, Dr. Hamilton Rice described his doings down to that date on his new survey expedition into the interior of South America (*Journal*, vol. 48, p. 354). Arriving at Pará on 30 November 1916, he ascended the Amazon in his steam yacht to Manaos, stopping at various points on the way, and examining the hills which fringe the great river and have been thought by some to be volcanic. The geologist's examination proved this to be a mistake. Unable to charter a steamer at once for the ascent of the Rio Negro, he decided to use the time of waiting for an ascent of the Solimões (Upper Amazon) to Iquitos, making as careful a traverse as possible, and checking the results on the return voyage. Wireless signals had been obtained almost nightly from Washington, except at Manaos, where the weather conditions were extremely bad. Good observations for latitude and time had however been secured. Having obtained a steamer, the party started up the Rio Negro on January 16, proceeding slowly and taking constant observations for latitude and time. Dr. Rice attaches great importance to the correct mapping of the river—a matter of difficulty by reason of its huge width and great number of shoals and sandbanks—as a basis for the mapping of the more remote regions. He thinks his results are as good as could be secured with the methods employed. With the launch and lighter he proposed to ascend the Casiquiari to the Orinoco, and push up the latter as far as possible into the country of the Guarahibos. Part of the mercurial barometer was unfortunately left at Pará when being sent out to Dr. Rice, so the idea of obtaining heights from Manaos to Esmeralda by its aid had had to be abandoned. Five aneroids are however being employed, readings being taken every two hours from 7 a.m. to 9 p.m. The chronometer and watches were keeping excellent time. The members of the expedition are the following: Prof. W. T. Councilman (of Harvard) and Dr. R. T. Lambert, pathologists; Dr. Ernest Howe (Harvard, Yale, and U.S. Geological Survey), geologist; Mr. Earl Church (Syracuse University and the U.S. Coast and Geodetic Survey), assistant topographer; J. C. Couzens (Columbia University), engineer; Mr. J. W. Soranson, wireless expert; and Mr. M. M. Robinson, photographer and kinema operator. It is evident that Dr. Rice has spared no pains to make the expedition a success.

OBITUARY

Mrs. Amaury Talbot.

We greatly regret to record the death of Mrs. D. Amaury Talbot, wife of the African traveller and Nigerian official, whose journeys and studies she had long shared. The cause of death was heart-failure due to exhaustion following an attack of malaria, which came on on December 23 while she was travelling in the bush in Nigeria. She was brought down to the Divisional Headquarters at Degema, but succumbed on December 28.

Mrs. Talbot had married in 1903, and since 1908 had spent most of her time in West and Central Africa. An enthusiastic botanist, she made extensive collections, which were sent to the British Museum, and described in part in a work published by the Museum in 1912. Of these plants over one hundred species were new to science, nine of them constituting new genera. Several

thousand in all were figured both in line and coloured drawings, Mrs. Talbot's sketches being remarkable for faithful representation of the originals. She took an important part in bringing together the large ethnological collection brought home from Nigeria, most of which is now in the British and Pitt Rivers Museums, and she shared with her husband the labour of writing the volume 'In the Shadow of the Bush,' which embodied the results of their West African experiences and studies, and which came out in 1912. She herself was the author of a valuable work, 'Woman's Mysteries of a Primitive People,' describing the life and customs of the Ibibio women of Southern Nigeria, which appeared in 1915. Three more books, in the preparation of which she helped her husband, are nearly ready for publication, but have been delayed by the war.

Mrs. Talbot's journeys, made in many cases under most trying circumstances, must have covered some 20,000 miles, and the bravery, endurance, and cheerfulness evinced during the course of them are described by her husband as remarkable.

CORRESPONDENCE

Geography in the United States.

I HAVE read with interest Mr. George G. Chisholm's recent paper in the *Geographical Journal* of November 1916, on the subject of "Geography in the United States." I think Mr. Chisholm has given an excellent analysis of the situation, and the *Annals* of the Association of American Geographers probably correctly represent the trend of published investigation in geography in the United States. This fact however needs to be kept in mind, that while there is a marked tendency toward humanizing geography in school and college teaching, the actual research work which is carried on both by geographers of the government or state surveys and by others is probably as largely as ever in physiography, meteorology, and other kindred branches, belonging to the physical sciences rather than to the social sciences. The courses in our schools and colleges which are growing most rapidly are those which lay stress on the human side of geography; yet this is probably not the field in which the largest number of original workers are engaged in the United States.

R. H. WHITBECK.

University of Wisconsin, Madison, Wisconsin.

MEETINGS: ROYAL GEOGRAPHICAL SOCIETY: SESSION 1916–1917

Eighth Evening Meeting, 19 February 1917.—The President in the Chair.

ELECTIONS.—Lieut. Edward Gathorne Harrison; Ralph Heyward Isham; Arthur Robertshaw; Bernard Percival de Watteville.

PAPER: The Baghdad Railway and its Tributaries. H. Charles Woods.

Ninth Evening Meeting, 5 March 1917.—The President in the Chair.

ELECTIONS.—J. C. Barley; Norman Biddell; Cyril Edward Nowill Bromehead; J. W. J. Cartner; Philip Henry Lockhart; Rev. A. Stuart McNairn; Aubrey de Lacy Mann; William Bertram Mitford; Francis William Watts.

PAPER: Geographical Work in India for the Society. Col. Sir Francis Younghusband.

Tenth Evening Meeting, 19 March 1917.—The President in the Chair.

ELECTIONS.—Rev. James A. Shaw Griffith; Lieut. Aage Benedict Salto, R.E.; Rev. Harry Woodward.

PAPER: Palestine: its resources and suitability for colonization. Dr. E. W. G. Masterman.

Third Afternoon Meeting, 22 February 1917.—The President in the Chair.

PAPER: The Origin and Growth of Dry Lakes in Western Australia. J. T. Jutson.

GEOGRAPHICAL LITERATURE: ADDITIONS TO THE LIBRARY.

Edward Heawood, Librarian, R.G.S.

For list of abbreviations see January number.

EUROPE

Adriatic—Political. *Scottish G. Mag.* **32** (1916): 466–477. **Newbigin.**
Italy and the Adriatic. By Marion I. Newbigin.

Albania—Cartography. *Riv. G. Italiana* **23** (1916): 269–277. **Almagià.**
Note di cartografia albanese. By Roberto Almagià. *Illustrations.*

Albania—Travel. *B.R.S.G. Italiana*, Ser. V. **5** (1916): 646–672, 805–823. **Santucci.**
Un viaggio nell' Albania settentrionale. By Stefano Santucci. *Illustrations.*

Belgium—Flora. *Ann. G.* **25** (1916): 321–327. **Massart.**
D'où vient la flore du littoral belge? Par Jean Massart. *Map and Illustration.*

Belgium—Linguistic areas. *Petermanns M.* **62** (1916): 241–247. **Gerstenhauer.**
Die verwaltungsrechtliche Abgrenzung der drei Sprachgebiete und die Schreibweise der Gemeindenamen in Belgien. Von M. R. Gerstenhauer.

Europe—South-Eastern. **Savić.**
The reconstruction of South-Eastern Europe. By Vladislav R. Savić. With a preface by Sir James George Frazer. London: Chapman & Hall, 1917. Size 9 × 5½, pp. x. and 280. *Map. Price* 7*s.* 6*d. net. Presented.*
See review at p. 305. A paper by the same writer on a similar subject appeared in the *Asiatic Review*, vol. 10, pp. 281–287.

Russia—Year-book. **Peacock.**
The Russian Year-book, 1916. Compiled and edited by N. Peacock. London: Eyre & Spottiswoode, [1917]. Size 8 × 5½, pp. viii. and 780. *Price* 10*s.* 6*d. net. Presented.*

Spain. **Piddington.**
Spanish sketches. By A. B. Piddington. London: Humphrey Milford, 1916. Size 7½ × 5, pp. viii. and 162. *Illustrations. Price* 5*s. net. Presented.*
Slight but readable sketches of Spanish places and personages. One, entitled 'Columbus in Seville,' describes the great navigator's associations with that city, and embodies a protest against the tendency towards detraction from his merits sometimes displayed of late.

ASIA

Arabia—Southern. *G.Z.* **22** (1916): 458–470. **Schmidt.**
The südarabische Kriegsschauplatz. Von Walther Schmidt. *Sketch-maps.*

China—Rainfall. *Monthly Weather Rev.* **44** (1916): 276–281. **Chu.**
Rainfall in China, 1900–1911. By Co-Ching Chu. *Illustrations.*

Eastern Asia—Historical. **Bertolini.**
B.R.S.G. Italiana, Ser. V. **5** (1916): 908–921.
Antichi monumenti della diffusione del cristianesimo nell' Estremo Oriente. By G. L. Bertolini. *Illustrations.*

India—Burma. **Enriquez.**

A Burmese Enchantment. By Captain C. M. Enriquez. Calcutta: Thacker, Spink & Co., 1916. Size 7½ × 5, pp. xii. and 320. *Maps and Illustrations. Presented.*

Like the author's previous works this gives a pleasantly written account of some of his experiences in out-of-the-way parts of the Indian borderlands. For Burma he evidently feels to the full the enthusiasm hinted at in the title.

Malay Archipelago—Borneo. **Shelford and Poulton.**

A Naturalist in Borneo. By the late Robert W. C. Shelford. Edited with a biographical introduction by Prof. Edward B. Poulton. London: T. Fisher Unwin, [1916]. Size 9 × 5½, pp. xxviii. and 332. *Illustrations. Price 15s. net. Presented.*

NORTH AMERICA

Alaska—Barry Glacier. **Johnson.**

U.S. Geol. Surv., Profess. Paper 98-C (1916): pp. 35–36.

Retreat of Barry glacier, Port Wells, Prince William Sound, Alaska, between 1910 and 1914. By Bertrand L. Johnson. *Illustrations and Sketch-maps.*

See note in the Monthly Record, March, p. 236.

Alaska—Bogoslof Volcano. *G. Rev.* 2 (1916): 218–221. **Powers.**

Recent changes in Bogoslof volcano. By Sidney Powers. *Sketch-map and Illustration.*

America—Cartographical History. **Derby.**

Rev. I. Hist. e G. Brasileiro, Tomo Especial, Parte II. (1915): 325–344.

Estudos cartographicos da primeira phase dos descobrimentos na America—1492–1502. (Nota preliminar). By Orville A. Derby.

Canada—Historical. **Lucas.**

A historical geography of the British Dominions. Vol. 5. Canada. Part I. Historical. By Sir Charles Lucas. 2nd edit. Oxford: Clarendon Press, 1916. Size 7½ × 5, pp. 364. *Maps. Price 6s. Presented.*

Canada—Water-power. **Dept. of the Interior.**

Department of the Interior. Water resources paper No. 16. Water powers of Canada. Ottawa, 1916. Size 10 × 7, pp. 362. *Maps, Illustrations, and Diagrams. Presented.*

Mexico. **Smith.**

Benighted Mexico. By Randolph Wellford Smith. London: John Lane. 1917. Size 8 × 5, pp. 390. *Price 6s. net. Presented.*

North America—Early Travel. **Birket.**

Some cursory remarks made by James Birket in his voyage to North America, 1750–1751. New Haven: Yale University Press (London: Humphrey Milford), 1916. Size 8½ × 5½, pp. vi. and 74. *Price 4s. 6d. net. Presented.*

No. 4 of the series of "Manuscripts and Edited Texts" included in the Yale Historical publications. The original diary seems originally to have belonged to the collection of Dr. William Thornton, a West India friend of Birket, but was preserved by the wife of Samuel Harrison Smith, founder of the *National Intelligencer*, by one of whose descendants it has been presented to Yale University.

CENTRAL AND SOUTH AMERICA

Andes. *J.G.* 15 (1916): 1–8. **Tower.**

The Andes as a factor in South American geography. By Walter S. Tower.

Andes—Nevado de Famatina. **Bodenbender.**

B.A. Nac. Ciencias Córdoba (*Rep. Argentina*) 21 (1916): 100–182.

El Nevado de Famatina. Por Guillermo Bodenbender. *Illustrations.*

Part of a chain traversing the Argentine provinces of Catamarca and La Rioja.

Argentine—Rio Negro. **Doering and Lorentz.**

B.A. Nac. Ciencias Córdoba (*Rep. Argentina*) 21 (1916): 300–386.

Recuerdos de la Expedición al Río Negro (1879). Por Adolfo Doering y Pablo G. Lorentz.

Argentine and Chile—Economic. *National G. Mag.* 30 (1916) : 121–142. **Willis.**
The awakening of Argentina and Chile. Progress in the lands that lie below Capricorn. By Bailey Willis. *Illustrations.*

Paraguay. **Koebel.**
Paraguay. By W. H. Koebel. London : T. Fisher Unwin, 1917. Size 9 × 5½, pp 348. *Map and Illustrations. Price* 10*s.* 6*d. net. Presented.*

AUSTRALASIA AND OCEANIC ISLANDS

Australia. **Gregory.**
Australia. By J. W. Gregory. Cambridge : University Press, 1916. Size 6½ × 4½, pp. 156. *Sketch-maps and Illustrations. Price* 1*s.* 3*d. net. Presented.*
One of the useful 'Cambridge Manuals' by one well qualified to write on Australia, its geography and economics.

Australia—Historical. **Scott.**
A short history of Australia. By Ernest Scott. London : Humphrey Milford, 1916. Size 7½ × 5, pp. xx. and 364. *Maps. Price* 3*s.* 6*d. Presented.*

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY

Economic Geography. **Dryer.**
Elementary economic geography. By Charles Redway Dryer. New York : American Book Co., 1916. Size 8 × 5½, pp. 416. *Maps, Diagrams, and Illustrations. Presented.*

History of Cartography. *B.R.S.G. Italiana*, Ser. V., 5 (1916) : 721–736. **Nallino.**
Un mappamondo arabo disegnato nel 1579 de Alî ibn Ahmad al-Sharafî di Sfax. By Carlo Alfonso Nallino. *Facsimile map.*
The draughtsman was father to the author of the very similar map of which a free copy (without many of the legends) was given by Jomard, and from him copied by Nordenskiöld. The present map was originally copied from one by the author's grandfather, itself based in large part on a Majorcan portolan map.

Historical—Early voyages. **Alexander.**
The earliest voyages round the world, 1519–1617. Edited by Philip F. Alexander. Cambridge : University Press, 1916. Size 8 × 6¼, pp. xxiv. and 216. *Maps and Illustrations. Price* 3*s. net. Presented.*
The latest addition to the excellent series of 'Cambridge Travel Books,' which aim at presenting elementary students of geography with concise summaries of the most important voyages and travels of the past.

Historical—Franciscan Missions. **Golubovich.**
P. Girolamo Golubovich. Biblioteca biobibliografica della Terra Santa e dell' Oriente Francescano. Tomo I. (1215–1300). Tomo II. (Addenda al Sec. xiii., e Fonti pel Sec. xvi.). Florence : Collegio di S. Bonaventura, 1906–1913. Size 11 × 7½, pp. (vol. 1) 480, (vol. 2) 642. *Maps. Price (two vols.)* 25*s.*
An important guide to the early missions of the Franciscans to Palestine and the East, but virtually limited to the work of that order. It is based on exhaustive research in the Franciscan archives, many documents from which are printed or summarized in the text. Other volumes will follow.

BIOGRAPHY

Duke of the Abruzzi. **Magistris.**
Biografie di Geografi e di Exploratori contemporanei. II. Luigi Amedeo di Savoia, Duca degli Abruzzi. By L. F. de Magistris. Novara, N.D. Size 7½ × 4, pp. 38. *Portrait.*

Gill. **Forbes.**
David Gill : Man and astronomer. Memories of Sir David Gill . . . (1879–1907) at the Cape of Good Hope. Collected and arranged by George Forbes. London : John Murray, 1916. Size 8½ × 5½, pp. x. and 418. *Portraits and Illustrations. Price* 12*s. net. Presented.*

GENERAL

Bibliography.
The English Catalogue of Books . . . Vol. 9. January 1911 to December 1915. London : The Publishers' Circular, 1916. Size 10 × 6, pp. 1582. *Price* 105*s. net.*

British Empire. **Cornish.**

Naval and military geography of the British Empire. (Considered in relation to the War with Germany.) Lectures given during 1914-16 to Officers of the Navy and Army. By Dr. Vaughan Cornish. London: H. Rees, 1916. Size 8½ × 5½, pp. vi. and 140. *Maps. Price 3s. 6d. net. Presented.*

See review in the March number, p. 232.

Catalogue. **War Office.**

Supplement to War Office Library Catalogue. Parts I. and II. Compiled by F. J. Huddleston. London: Harrison & Sons, 1916. Size 9½ × 6, pp. 744. *Presented.*

The first Decennial supplement to Parts 1 and 2 of the existing catalogue, which came out in 1906 and 1910 respectively. They embrace an authors catalogue and list of official and other publications, and are brought down to the end of 1915.

Exploration. *Smithsonian Misc. Coll.* **66** (1916): No. 3, pp. 119. **Smithsonian Inst.**

Explorations and field-work of the Smithsonian Institution in 1915. *Illustrations.*

Account of scientific investigations in various parts of the world (Rocky Mountains, Siberia, Borneo and Celebes, China and Manchuria, Brazil and Argentina, etc.).

Geography of Disease. *South African J. Sc.* **12** (1916): 474–501. **Kehoe.**

The influence of the climatic and tellurical factors on the distribution and spread of certain animal diseases, with special reference to the conditions occurring in South Africa. By D. Kehol.

Indian Ocean—Navigation. **Gallé.**

Koninklijk Nederlandsch Meteorologisch Instituut, No. 102. Mededeelingen en Verhandelingen. 20. De stoomwegen van Zuid-Afrika naar Oost-Indië. By P. H. Gallé. Utrecht: Kemink and Zoon, 1916. Size 9½ × 6½, pp. 24. *Map.*

On the weather, currents, etc., on the routes across the Indian Ocean.

Political Geography—Frontiers. **Holdich.**

Political frontiers and boundary making. By Colonel Sir Thomas H. Holdich. London: Macmillan & Co., 1916. Size 8½ × 5½, pp. xii. and 308. *Price 10s. net. Presented.*

See review in the January number, p. 58.

Travel. **Roth.**

Sketches and reminiscences from Queensland, Russia, and elsewhere. By H. Ling Roth. [Reprinted from the *Halifax Courier*, September 1915 to May 1916.] Size 9½ × 7, pp. 40. *Illustrations.*

Mr. Ling Roth here brings together some interesting reminiscences of his early travels, during which he saw a good deal of unconventional life in various parts of the world.

NEW MAPS AND PHOTOGRAPHS: ADDITIONS TO THE MAP ROOM.

E. A. Reeves, Map Curator, R.G.S.

EUROPE

Albania. **Freytag.**

G. Freytags Karte von Albanien. Scale 1 : 600,000 or 1 inch to 9·47 stat. miles. Size 25 by 17·5 inches. Vienna: G. Freytag & Berndt, [1916]. *Price 1 Kr.*

A general map of Albania and parts of adjacent countries with relief in brown shading.

Balkan Peninsula. **Bacon.**

Large-scale Map of the Salonika Battle Front. Scale 1 : 380,160 or 1 inch to 6 stat. miles. Size 18 by 28 inches. London: G. W. Bacon & Co., Ltd., [1916]. *Price 1s. net on paper, 1s. 6d. on cloth. Presented by the Publishers.*

A general map useful for following the military operation on the Salonika Front, showing relief by tinted layers at 1000 feet vertical intervals.

Balkan Peninsula. **Forest.**

J. Forest. Etats des Balkans et Roumanie. Scale 1 : 1,500,000 or 1 inch to 23·67 stat. miles. Size 37 by 27 inches. Paris: J. Forest, [1917].

A general map of the Balkan States showing means of communications. An attempt has been made to indicate relief by shading, but this is not very successful. International boundaries are clearly shown in colours.

Belgium and France. **Geographical Section, General Staff.**

Belgium and North-East France. Scale 1 : 100,000 or 1 inch to 1·58 stat. miles. Sheets : 1 A, Dunkerque ; 2, Ghent ; 5, Tournai, 2nd edit. ; 5 A, Hazebrouck, 2nd edit. ; 11, Lens, 2nd edit. ; 12, Valenciennes, 2nd edit. ; 17, Amiens, 2nd edit. ; 18, St. Quentin ; 21, Beauvais. Size 23 by 28 inches. Geographical Section, General Staff, No. 2364. War Office, 1915–16. *Price 2s. net each sheet. Presented by the Director of Military Intelligence.* London Agents : E. Stanford, Ltd. ; Sifton, Praed & Co. ; T. Fisher Unwin.

British Isles. **Geological Survey.**

Geological Survey of England and Wales. Scale 1 : 63,360 or 1 inch to 1 stat. mile. Sheet 62 (Drift), Harrogate. Size 13 by 19 inches. Published in colour by the Director-General, Ordnance Survey, at the Ordnance Survey Office, Southampton, 1917. *Price 1s. 6d. net. Presented by the Director of the Geological Survey.*

British Isles. **G. W. Bacon & Co.**

Bacon's New Physical Wall Atlas of the British Isles. Containing seven maps, each 30 by 40 inches. Scale 1 : 1,187,000 or 1 inch to 18·7 stat. miles. London : G. W. Bacon & Co., Ltd., 1917. *Price, mounted on cloth, 21s. the set. Presented by the Publishers.*

This set of maps belongs to Bacon's Wall Atlas Series. It consists of seven maps of the British Isles on the same scale, drawn on the conical projection, and dealing with the following subjects : (1) Geology and Co-tidal lines, (2) Contours, (3) Annual January and July Isotherms, (4) Rainfall and Isobars, (5) Natural Vegetation and Industrial Productions, Coalfields, and Fisheries, (6) Density of Population, (7) Communications (Railways and Sea Routes). The maps are clearly printed in colour layers, combined with various symbols and lines ; and on the whole give a good general idea of the leading features of the subjects with which they are concerned. It is difficult to see why such an odd scale has been selected.

Special sets of not less than four maps can be supplied to suit the requirements of teachers, mounted on cloth, cut to fold, in a box, at the very moderate price of 3*s.* 6*d.* and 5*s.* each map.

British Isles. **Krehbiel.**

The Parliamentary Constituencies of the British Isles and the Results of the General Elections since 1886. Compiled by Edward Krehbiel. Scale 1 : 2,000,000 or 1 inch to 31·56 stat. miles. Size 20 by 17 inches. From the *Geographical Review*, vol. 2, 1916, Plate V. New York : American Geographical Society, 1916. *Presented by the American Geographical Society.*

Accompanies the paper by Edward Krehbiel on the Geographic Influences of British Elections, published by the American Geographical Society of New York in the *Geographical Review* for December last. It shows by means of colour tints and symbols constituencies always Conservative, Liberal, or Nationalist ; those returning a majority of Conservatives, Liberals, or Nationalists ; constituencies that vacillate politically, and other information concerning the political representation of the various constituencies of the British Isles.

British Isles. **Railway Clearing House.**

Official Railway Map of England and Wales. Scale 1 : 475,200 or 1 inch to 7·5 stat. miles. Four sheets, each 28 by 23 inches. Prepared and published at the Railway Clearing House. London, 1917. *Price 12s. 6d.*

British Isles—Scotland. **Geological Survey.**

Geological Survey of Scotland. Scale 1 : 63,360 or 1 inch to 1 stat. mile. Sheets : 36, Kilmartin ; 60, Rhum. Size 18 by 24 inches. Published in colour by the Director-General, Ordnance Survey, at the Ordnance Survey Office, Southampton, 1917. *Price 2s. 6d. net each sheet. Presented by the Director of the Geological Survey.*

Denmark. **Generalstabens Topografiske Afdeling.**

Kongeriget Danmark i Maalestokken 1 : 500,000 (1 inch to 7·89 stat. miles). Two sheets each 15 by 26 inches. Copenhagen : Generalstabens Topografiske Afdeling, 1915. *Presented by the Danish Government.*

Denmark. **Generalstabens Topografiske Afdeling.**

Topografisk Kort over Kongeriget Danmark udarbejdet og udgivet af Generalstaben. Scale 1 : 40,000 or 1·6 inch to 1 stat. mile. Sheets : Frederikssund ; Roskilde ; Selsö. Size 15 by 19 inches. Copenhagen : Generalstabens Topografiske Afdeling, 1915. *Presented by the Danish Government.*

Denmark. **Sørensen.**

Danske Søkort. Af Jens Sørensen 1646–1723. Med Dansk og Engelsk Tekst. Paa Carlsbergfondets Bekostning udgivne af Johannes Knudsen. Size 26 by 20 inches. Copenhagen: F. Hendriksens Reproduktions-Atelier, 1916. *Price* 60 *Kr.*

This is a portfolio containing photographic facsimiles of twenty charts of Denmark and the neighbouring coasts from the surveys of the Danish hydrographer Jens Sørensen, made between the years 1690 and 1720, and now reproduced for the first time.

Until the latter part of the 17th century the only charts that existed of the coasts of Denmark, with the exception of one or two by Jørgen Dinesend Oxendorph, appear to have been made by foreign navigators, and most of these were so inaccurate as to be of little value; but in 1689 Jens Sørensen, a native of Sølvitsborg, who had already gained experience in navigation and nautical surveying, was instructed by the king to undertake the charting of the coasts, for which he was to be paid a yearly salary of 300 rix-dollars. He immediately began work in earnest, and although it is not known exactly how many charts he produced, it is supposed that altogether they exceeded one hundred, over fifty of which are still preserved in the Danish Hydrographic Office at Copenhagen. In the drawing of some of the charts Sørensen had the assistance of others who were appointed to help him in his work. Notwithstanding promises that had been made by the Government to publish these charts, this, owing to want of funds, was never done. In fact, Sørensen, during the latter part of his work, found it impossible to get his salary, and was reduced to poverty.

None of the charts are marked in degrees, even of latitude, and no astronomical observations for the determination of positions was ever attempted. The orientation is arbitrary, and they are merely plain charts not drawn on any system of projection. Still they form an interesting collection, and are far superior to anything of the kind previously attempted. They contain a considerable amount of detailed information, and speak well for the skill and industry of their author.

ASIA

Federated Malay States. **Surveyor-General, F.M.S.**

Topographical Survey of the Federated Malay States. Scale 1 : 63,360 or 1 inch to 1 stat. mile. Published under the direction of the Surveyor-General, F.M.S. Sheets: 3–A 3, Rungkup, Perak; 3–A 4, Bagan Datoh, Perak; 3–G 9, Tampin, Negri Sembilan. Size 18 by 18 inches. Kuala Lumpur. Central Survey Office, 1916. *Presented by the Surveyor-General, F.M.S.*

Sheets of the new survey of the Federated Malay States, which was first noticed in the *Geographical Journal* for February 1914.

Japan. **Imperial Geological Survey.**

Geological Map of Japan. Scale 1 : 400,000 or 1 inch to 6·3 stat. miles. Divisions III. and V.—Mineral Map of Japan. Scale 1 : 400,000 or 1 inch to 6·3 stat. miles. Divisions III. and V. Tokyo: Imperial Geological Survey of Japan, 1914 and 1916. *Presented by the Imperial Geological Survey of Japan.*

Division III. includes the part of Hondo extending from 134° 55′ to 138° 5′ E. long., thus embracing Osaka, Kyoto, Nagoya, and Tayama; and Division V. extends from E. long. 129° to 132° 30′ and includes the whole of the island of Kirishiu with parts of the adjacent islands. The geological maps were first published in 1890. The Mineral Maps are the geological maps with the location of the various minerals, indicated by numbers and symbols on the top of the geological colouring. Information is also given concerning the amount of the mineral production, based on the statistics of the year 1912.

Malay Peninsula. **Surveyor-General, F.M.S.**

Map of British Malaya, including the Straits Settlements, Federated Malay States, and Malay States not included in the Federation. Scale 1 : 760320 or 1 inch to 12 stat. miles. 2 sheets, each 17 by 30 inches. Published under the direction of the Surveyor-General, Federated Malay States. Kuala Lumpur: F.M.S. Survey Department, 1916. *Presented by the Surveyor-General, Federated Malay States.*

A useful general map including all the part of the Malay Peninsula to the south of the 7th degree of N. latitude. Railways open and under construction are clearly shown, as are also roads and paths, of which the character is distinguished by various signs. Boundaries are shown by various coloured lines.

AFRICA

Egypt. **Mader.**

Hölzels Handkarte von Ägypten und den übrigen Nilländern, bearbeitet von Karl Mader. Scale 1 : 4,000,000 or 1 inch to 63·13 stat. miles. Size 30 by 23 inches. Vienna : Ed. Hölzel, 1916. *Price* 2.50 *Kr.*

A general map of Egypt and the Sudan, Abyssinia, Western Arabia, the Red Sea, and the Eastern Mediterranean. There are, as insets, a plan of the Suez Canal on the scale of 1 : 1,000,000, and a small general map of Western Asia on the scale of 1 : 20,000,000.

AMERICA

Canada. **Dept. of the Interior, Ottawa.**

Sectional Map of Canada. Scale 1 : 190,080 or 1 inch to 3 stat. miles. Sheet 564, Panny River, 1st edit., May 1, 1916. Size 17 by 28 inches. Ottawa: Department of the Interior, 1916. *Presented by the Department of the Interior, Ottawa.*

Canada. **Dept. of the Interior, Ottawa.**

Cereal maps of Alberta, Manitoba, and Saskatchewan, showing acreage under crop in each township in wheat, oats, barley, and flax during 1915. Scale 1 : 792,000 or 1 inch to 12·5 stat. miles. Prepared in the Railways Lands Branch under the direction of F. G. C. Lynch, Superintendent, from data supplied by the Provincial Government and Census Branch, Department of Trade and Commerce. 4th edit. Ottawa : Department of the Interior, 1916. *Presented by the Railway Lands Branch, Department of the Interior.*

Canada. **Dept. of the Interior, Ottawa.**

Sectional Map of Canada. Scale 1 : 190,080 or 1 inch to 3 stat. miles. Sheets : 21, Turtle Mountain, Manitoba, Saskatchewan, 6th edit. ; 266, Ribstone Creek, Alberta, 7th edit. ; 272, Long Point, Manitoba, 1st edit. ; 322, Grand Rapids, Manitoba, 1st edit. Size 17 by 31 inches. Ottawa: Department of the Interior, Topographical Surveys Branch, 1916. *Presented by the Department of the Interior, Ottawa.*

Canada—British Columbia. **Surveyor-General, B.C.**

Topographical Sketch-map of Omineca and Finlay River Basins. Scale 1 : 316,800 or 1 inch to 5 stat. miles. Size 38 by 25 inches. Victoria, B.C. : Surveyor-General's Office, 1916. *Presented by the Surveyor-General, British Columbia.*

This map is compiled from exploratory surveys made by F. C. Swannell, B.C.L.S., in 1912–13–14, and from information furnished by other British Columbia land surveyors and explorers. Heights are barometric, and approximate contours are drawn at 500-feet vertical intervals.

United States. **U.S. Geological Survey.**

Geologic Atlas of the United States. Folios : 199, Silver City, New Mexico ; 200, Galena–Elizabeth, Illinois–Iowa ; 201, Minneapolis–St. Paul, Minnesota. Size 22 by 19 inches. Washington : United States Geological Survey, 1916. *Presented by the Director, U.S. Geological Survey.*

As is the case with the other folios of this important survey the first of the maps gives the topographical features with contours in brown, then follow the same sheets with the geology shown by colour-tinting and symbols, and after that sheets of photographic reproductions of typical geological features, and sections. In addition there are several pages of carefully written explanatory and descriptive text, well illustrated by diagrams and sketches. On the Minneapolis–St. Paul and the Galena–Elizabeth maps the contours are at 20-feet vertical intervals, while on the Silver City maps they are at 100-feet intervals.

N.B.—It would add greatly to the value of the collection of Photographs which has been established in the Map Room if all the Fellows of the Society who have taken photographs during their travels would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

80
70
60
CARIBBEAN SEA
Punta Gallinas
Gulf of Maracaibo
Santa Marta
R. Magdalena
Barranquilla
Cartagena
Puerto Cabello
La Guaira
Caracas
Port of Spain
Trinidad
Canal Colon
Gulf of Darien
Panama
Gulf of Panama
Valencia
CARACAS
Mouths of the O
R. Orinoco
R. Apure
VENEZUELA
R. Essequ
Georg
COLOMBIA
Nemocon
Meta
Rapids
Rodstane
British
BOGOTA
Buenaventura
Girardot
R. Guaviare
R. Parima
Savannah
Caatle
Leasto Mts
R. Yapura
QUITO
Chimborazo
Cotopaxi 19554
R. Napo
R. Yapura
R. Negro
Manaos
Guayaquil
Gulf of Guayaquil
Tumbez
Iquitos
R. Amazon
R. Maranon
R. Javary
Payta
Chiclayo
R. Purus
R. Madeira
Guadalupe
Pacasmayo
R. Juruá
Chimbote
Pto Velho
Falls
Guajara Merim
Huacho
Callao
LIMA
Huaraz
Riberalta
Ayacucho
Cuzco
Llanos de Mojos
Parecis Rang
Matto Grosso
Titicaca 12508
Arequipa
Puno
BOLIVIA
Mollendo
Ilo
Cochabamba
Oruro
Arica
Pisagua
Sucre
Potosi
Iquique
Tupiza
Lagunas
Tocopilla
Isabel
Mejillones
Tropic of Capricorn
Antofagasta
El Toquete
Jujuy
Embarcacion
PARAGU

50
40
10
0
20
SOUTH AMERICA
SHEWING THE PRINCIPAL ROUTES
AND
ZONES OCCUPIED BY RAILWAYS
Scale 1/20,000,000 or 1 Inch = 315·6 Statute Miles.
100 0 100 200 300 400 500 Stat. Miles
Heights in feet.
of the Orinoco
R. Essequibo
Georgetown
New Amsterdam
R. Corentyne
Paramaribo
Cayenne
Makami
Dutch
French
Calçoene
Cabo do Norte
Mouths of the Amazon
Rio Para (Tocantins)
Salinas
Pará
(Belem)
S. Luiz
Camocim
Fortaleza
Maranhão
Natal
C. S. Roque
Paralyba
Pernambuco
(Recife)
Therezina
Jaguaribe
Propriá
R. São Francisco
Aracaju
Tombo
Bahia
(São Salvador)
Caravellas
Victoria
Rio de Janeiro
Santos
São Paulo
Corumba
Cuyaba
Matto Grosso
Minas Geraes
Bahia
R. Amazon
R. Tapajos
R. Xingu
R. Tocantins
R. Araguaya
R. Paraguay
R. Apa
Iguassu Falls
Parana
Forest
Country
Frontier
Mts
Tropic of Capricorn

Sinusoidal Equal Area Projection

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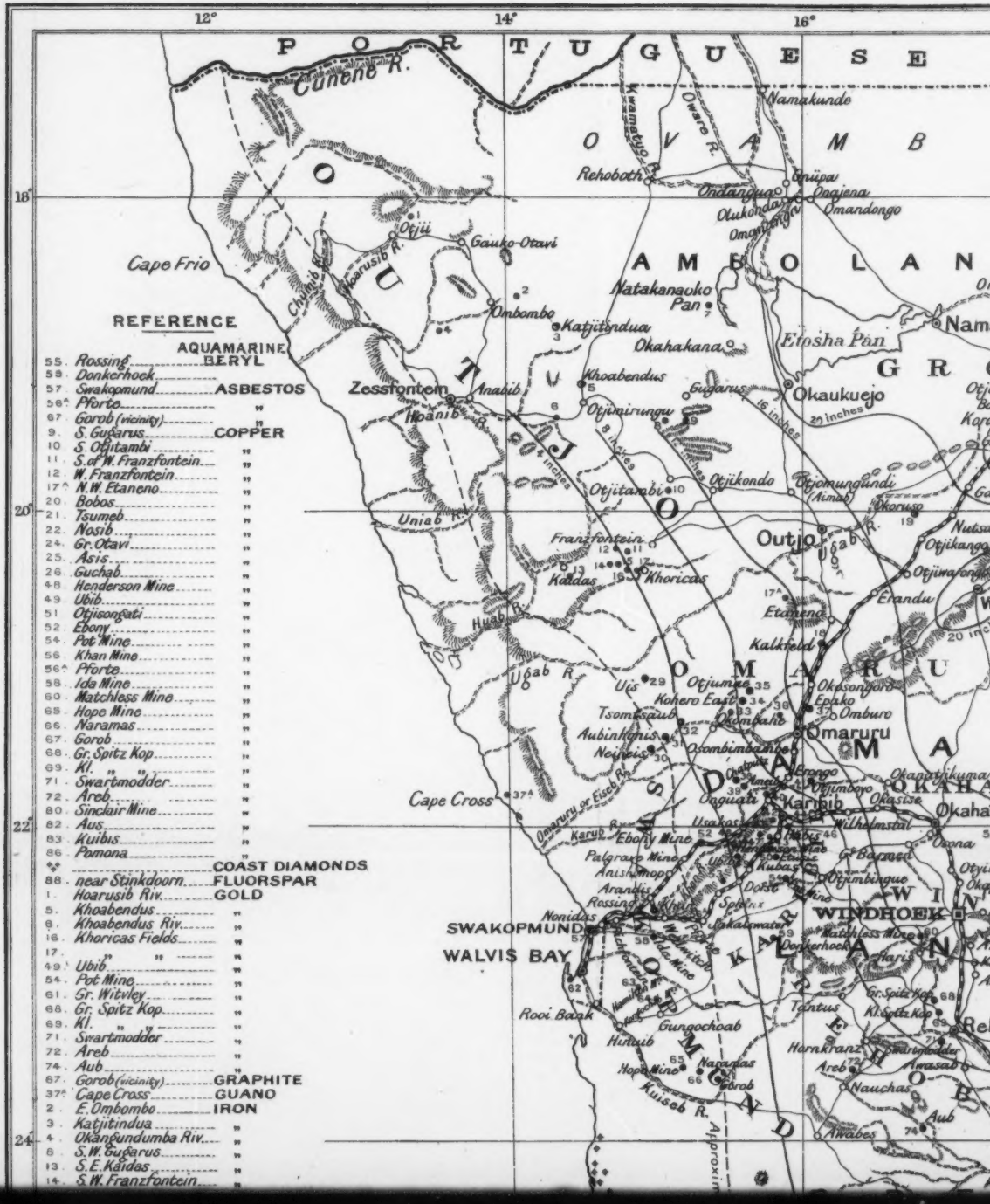
SOUTH AMERICAN RAILWAYS
Barclay.

Protectorate of
SOUTH WEST AFRI
to illustrate the paper by
T. TÖNNESEN, C.E.



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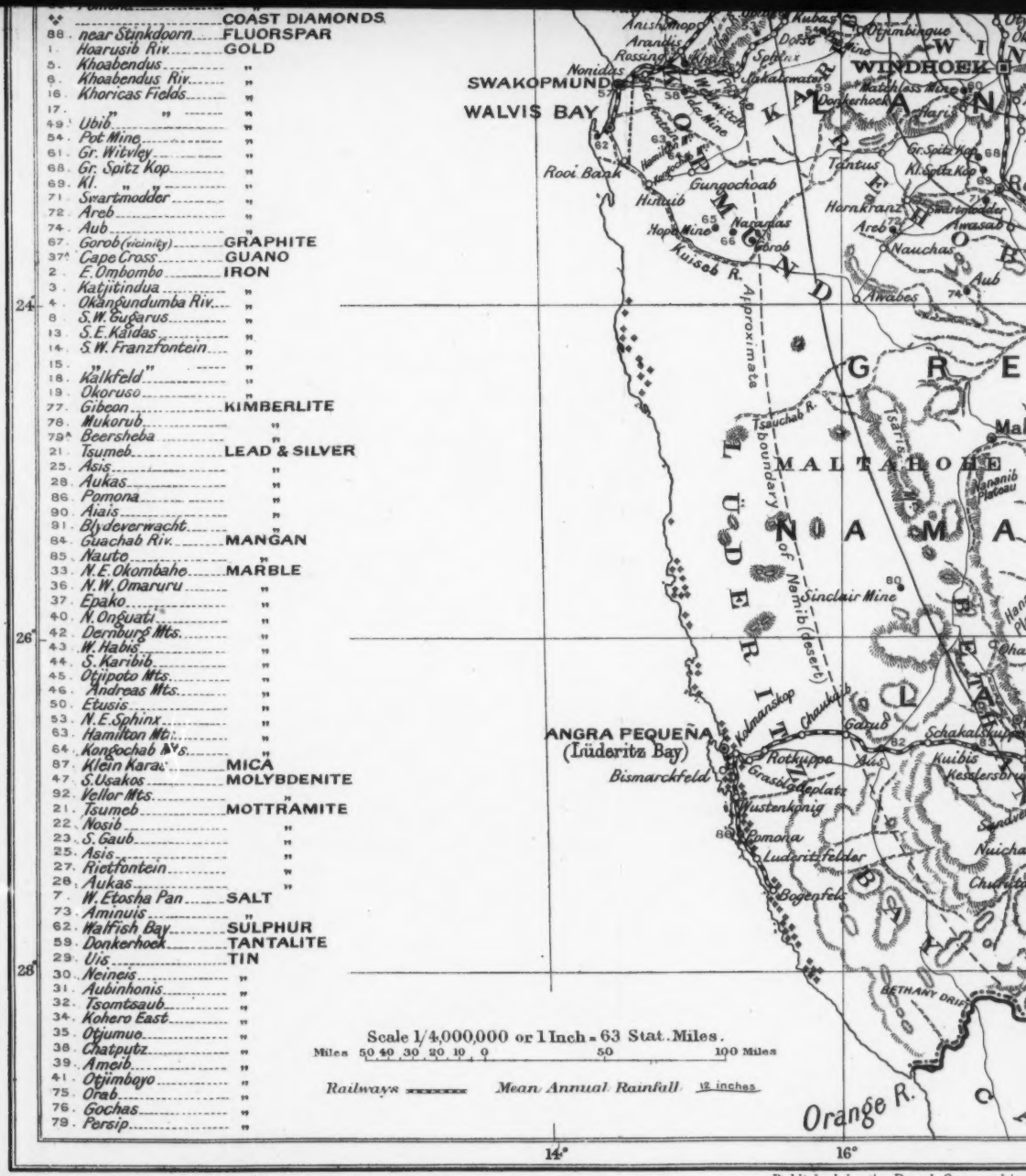

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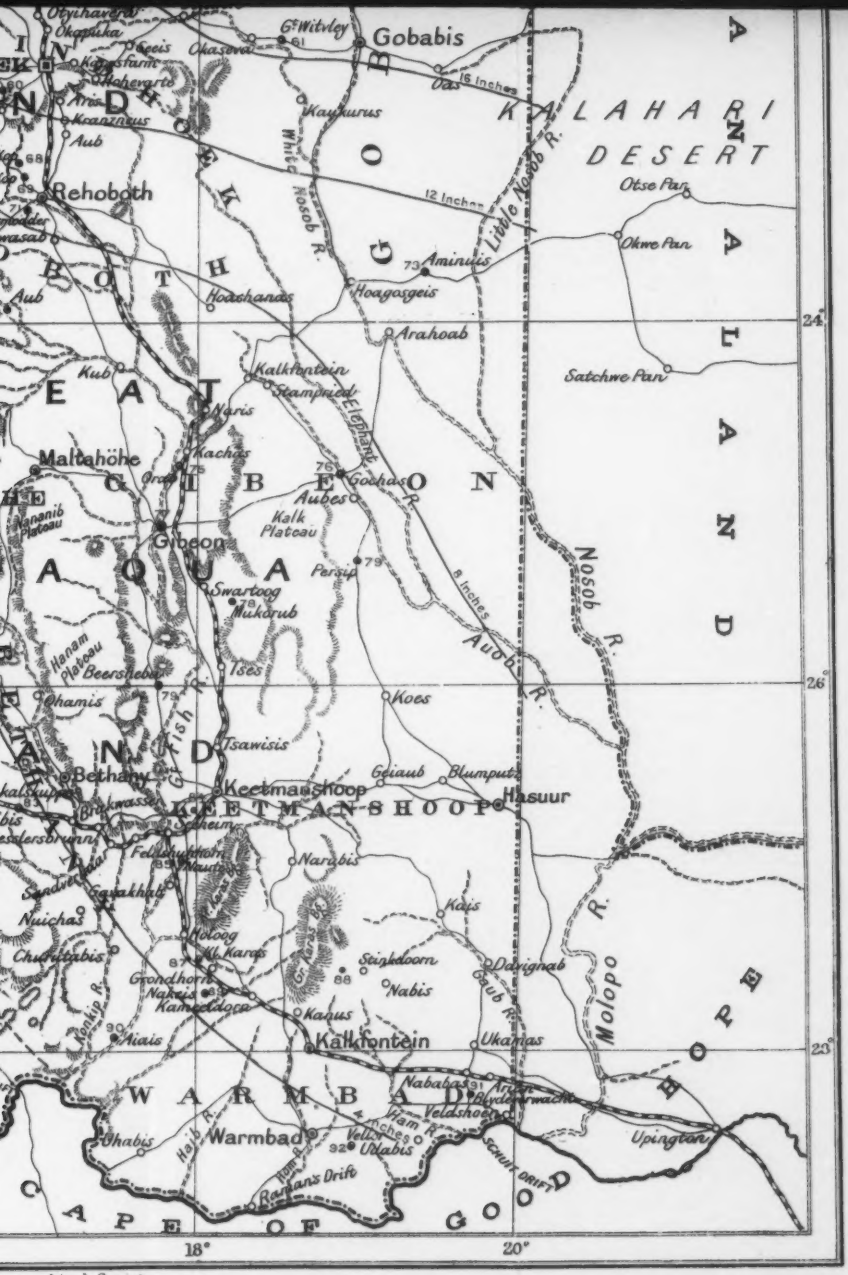
Note.

This map is a photo-lithographic reduction of a drawing supplied by the author.
The spelling of the place names has not been reduced to a system, and should not be taken as authoritative.


Gobabis
Witvley
Otjihavera
Okapuka
Chaseva
Kaukurus
Rehoboth
Aub
Hoachanas
Hoagasgeis
Aminuis
Otse Pan
Okwe Pan
Satchwe Pan
Arahoab
Kalkfontein
Stampried
Maltahöhe
Kachas
Gochas
Aubes
Kalk Plateau
Gibeon
Persip
Swartoog
Mukorub
Beersheba
Ohamis
Koes
Tsawisis
Bethany
Keetmanshoop
Geiaub
Blumputs
Hasuur
Narubis
Kais
Nuichas
Stinkdoorn
Daviguab
Nabis
Kapus
Kalkfontein
Ukamas
Nababeb
Arahoab
Blydenmacht
Veldschoen
Upington
Ohabis
Warmbad
Ulabis
Rehoboth
Gt Witvley
Gobabis
Aminuis
Aranos
Kalahari Desert
Otse Pan
Okwe Pan
Satchwe Pan
Maltahöhe
Gibeon
Keetmanshoop
Warmbad
Upington
Kalkfontein
Hasuur
Koes
Aubes
Gochas
Arahoab
Hoagasgeis
Hoachanas
Aminuis
Kaukurus
Witvley
Gobabis
Rehoboth
Aub
Kub
Nauis
Kachas
Swartoog
Mukorub
Persip
Tsawisis
Bethany
Geiaub
Blumputs
Narubis
Kais
Stinkdoorn
Daviguab
Nabis
Kapus
Kalkfontein
Ukamas
Nababeb
Blydenmacht
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